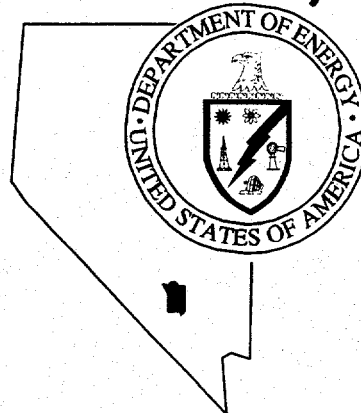


Nevada
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CAU No. 417: Revision 0

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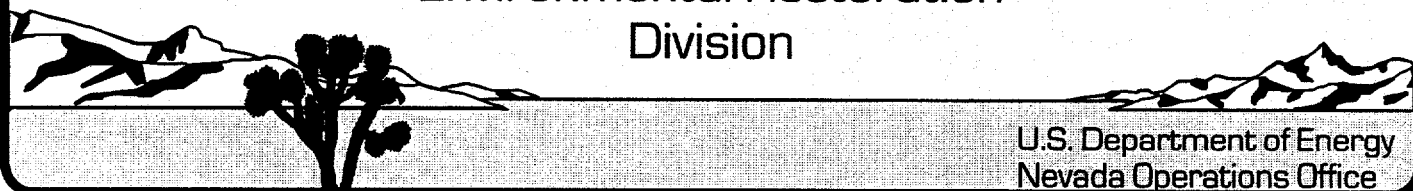
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April 1997

MASTER

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office



**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CENTRAL NEVADA TEST AREA
CAU NO. 417: Revision 0**

DOE Nevada Operations Office
Las Vegas, Nevada

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April 1997

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**CORRECTIVE ACTION INVESTIGATION PLAN
FOR CENTRAL NEVADA TEST AREA
CAU NO. 417**

Approved by:

Janet Appenzeller-Wing

Janet Appenzeller-Wing, Project Manager,
Offsites Subproject

Date:

4/10/97

Approved by:

Stephen A. Mellington for

Stephen A. Mellington, Project Manager,
Nevada Environmental Restoration Project

Date:

4/10/97

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List of Acronyms and Abbreviations

AEC	U.S. Atomic Energy Commission
ASE	Accelerated Solvent Extraction
BLM	U.S. Bureau of Land Management
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS(s)	Corrective Action Site(s)
CAU(s)	Corrective Action Unit(s)
CFR	<i>Code of Federal Regulations</i>
cm	Centimeter(s)
CMP	Central Mud Pit
CNTA	Central Nevada Test Area
COPC(s)	Contaminant(s) of potential concern
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOT	U.S. Department of Transportation
DQO(s)	Data Quality Objective(s)
EM	Electromagnetic induction
EP-TOX	Extraction Procedure Toxicity
EP	Extraction procedure
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ERP	Environmental Restoration Project
ESC	Expedited Site Characterization
FFACO	<i>Federal Facility Agreement and Consent Order</i>
FLAA	Flame Atomic Absorption
ft	Foot (feet)
GPR	Ground-penetrating radar
H&N	Holmes and Narver
HASP	Health and Safety Plan
IDW	Investigation-derived waste
in.	Inch(es)
IT	IT Corporation
km	Kilometer(s)
km ²	Square kilometer(s)
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory

List of Acronyms and Abbreviations (Continued)

LLW	Low-level waste
LTHMP	Long-Term Hydrologic Monitoring Program
m	Meter(s)
MDL	Minimum detectable level; also method detection limit
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
mi	Mile(s)
mi ²	Square mile(s)
NDEP	Nevada Division of Environmental Protection
NS	Not specified
NTS	Nevada Test Site
oz.	Ounce(s)
pCi/g	PicoCurie(s) per gram
PE	Performance evaluation
PPE	Personal protective equipment
QA/QC	Quality assurance/quality control
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
REECo	Reynolds Electrical & Engineering Co., Inc.
RPD	Relative percent difference
RSD	Relative standard deviation
RSL	Remote Sensing Laboratory
SGZ	Surface ground zero
SSL	Soil screening level
TAT	Technical Advisory Team
TBD	To be determined
TCLP	Toxicity Characteristics Leaching Procedure
TPH(s)	Total petroleum hydrocarbon(s)
UST	Underground storage tank(s)
XRF	X-ray fluorescence
°C	Degree(s) Celsius
%R	Percent recovery

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) is part of a U.S. Department of Energy (DOE)-funded environmental investigation of the Central Nevada Test Area (CNTA) (Corrective Action Units [CAUs] No. 417 and 443). The CNTA is located in Hot Creek Valley in Nye County, Nevada, adjacent to U.S. Highway 6, about 15 kilometers (km) (10 miles [mi]) northeast of Warm Springs. The CNTA was the site of Project Faultless, a nuclear device detonated in the subsurface by the U.S. Atomic Energy Commission (AEC) in January 1968. The purpose of this test was to gauge the seismic effects of relatively large, high-yield detonations completed outside of the Nevada Test Site (NTS). The test was also used to determine the suitability of the site for future large detonations. The yield of the Faultless test was between 200 kilotons and 1 megaton (DOE, 1994c). Two other similar tests were planned for the CNTA, but neither one of them was completed (AEC, 1974).

This CAIP is prepared in a manner consistent with the principals of Expedited Site Characterization (ESC) which applies techniques such as on-site analytical facilities, on-site data management and interpretation, and a dynamic (flexible) work plan in order to minimize the potential for subsequent work episodes. Section 1.4 provides a more detailed discussion of the ESC method.

This CAIP is designed and will be implemented in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) completed for the NTS and related DOE sites, including the CNTA (FFACO, 1996), the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE, 1996), and all applicable Nevada Division of Environmental Protection (NDEP) policies and regulations.

1.1 Purpose

This CAIP addresses the surface investigation and characterization of 15 identified Corrective Action Sites (CASs). In addition, several other areas of the CNTA project area have surface expressions that may warrant investigation. These suspect areas will be characterized, if necessary, in subsequent CAIPs or addendums to this CAIP prepared to address these sites. This CAIP addresses only the 15 identified CASs as shown in Table 2-1 that are associated with the drilling and construction of a number of testing wells designed as part of an underground nuclear testing program. The purpose of the wells at the time of construction was to provide subsurface

access for the emplacement, testing, and post detonation evaluations of underground nuclear devices. If contamination is found at any of the 15 surface CASs, the extent of contamination will be determined in order to develop an appropriate corrective action.

1.2 Scope

The scope of the CNTA corrective action investigation includes the following elements:

- Surface geophysical surveys
- Sampling and analysis of potentially contaminated soil

Each of these elements is outlined in detail in Sections 3.0 and 4.0 of this plan.

1.3 Federal Facility Agreement and Consent Order Requirements

The FFACO requires that CAIPs include or reference the following components needed to conduct an investigation:

- Project Management
- Technical
- Quality Assurance/Quality Control
- Health and Safety
- Public Involvement
- Field Sampling, as applicable
- Waste Management, as applicable

Six of the seven components are discussed in other site-specific project documents. Project Management protocol is discussed in the DOE Nevada Operations Office (DOE/NV) *Environmental Restoration Project (ERP) Project Management Plan* (DOE, 1994b). Field and laboratory Quality Assurance and Quality Control (QA/QC) procedures applicable to the CNTA investigation are detailed in the *Industrial Sites QAPP*, Revision 1 (DOE, 1996). Additional field QA/QC procedures are discussed in contractor-specific procedures, and the Health and Safety aspects of this project are documented in the DOE/NV Environmental Restoration Project *Health and Safety Plan* (HASP) (DOE, 1994a). They will also be supplemented by a site-specific HASP written prior to commencement of field work. Public involvement is documented in the draft Public Involvement Plan for the NTS which, when finalized, will be incorporated as Appendix V of the FFACO. Technical, field sampling activities and methods are detailed in Section 4.0, and investigation-derived waste (IDW) management is discussed in Section 5.0 of

this CAIP. A crosswalk between the FFACO requirements and the contents of this CAIP is presented in Table 1-1.

Table 1-1
Federal Facility Agreement and Consent Order
Requirements/Corrective Action Investigation Plan Crosswalk

FFACO Requirement	Where the Requirement is Met
Project Management	DOE/NV ERP <i>Project Management Plan</i>
	CAIP - Time Frame Schedule - Section 6.0
Technical	CAIP - Sections 3.0, 4.0, and Appendix C
Quality Assurance/Quality Control	<i>Industrial Sites QAPP</i> and Contractor Procedures
Health and Safety	DOE/NV ERP <i>Health and Safety Plan</i>
	Site-Specific Health and Safety Plans
Public Involvement	Draft Public Involvement Plan
Field Sampling	CAIP - Section 4.0
Waste Management	CAIP - Section 5.0
Time Frame	CAIP - Section 6.0

1.4 Expedited Site Characterization Methodology

The ESC methodology incorporates on-site decision-making technologies that permit site characterization to be completed in one continuous phase. It has been demonstrated that the characterization phase can be streamlined without compromising data quality. By using on-site analytical technologies, the need to send nearly all samples off site is minimized. By providing on-site decision-making capability, the ESC methodology can significantly reduce the probability of having to return to the site to fill data gaps. As a result, the current multiphase time sequence of data acquisition (consisting of sampling, analyzing, evaluating, and planning that typically takes years) becomes compressed into a single real-time phase, requiring only months to complete. Because each new piece of information is dictated by analysis of all past data, its information content is maximized. The result is not only quicker, but more effective site characterization.

The on-site decision-making component of ESC is implemented by a core team of mid- to senior-level personnel with extensive experience and training in the scientific disciplines applicable for the site. A description of the roles and responsibilities of this core team is presented in Appendix A.

2.0 Facility Description

This section presents a summary of site information excerpted from the following historical documents (see Section 7.0 for full reference information):

- U.S. Atomic Energy Commission, *Planning Directive: Demobilization, Restoration, and Monitoring, CNTA* (AEC, 1973)
- U.S. Atomic Energy Commission, *Summary Report: Central Nevada Test Area Demobilization and Restoration Activities* (AEC, 1974)
- Eberline Instrument Corporation, *Radiation Contamination Clearance Report for Central Nevada Test Area*, prepared for AEC (Eberline, 1973)
- Reynolds Electrical & Engineering Co., Inc., *Hazardous Waste Installation Assessment Report* (REECo, 1986)
- Desert Research Institute, *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Area* (DRI, 1988)

Additional information was obtained from historical and recent aerial photographs of the CNTA obtained from the DOE Nevada Operations Office Remote Sensing Laboratory (RSL), operated by Bechtel Nevada (RSL, 1968; RSL, 1993). The site photographs were reviewed by DOE and IT Corporation (IT) concurrently with a site reconnaissance visit on February 13 and 14, 1996.

2.1 CNTA Site History

The CNTA consisted of several separate land withdrawals, land easements, and special land-use permits obtained by the AEC from the U.S. Bureau of Land Management (BLM). For the Faultless device emplacement boring (UC-1), a 2.59-square kilometer (km²) (one square mile [mi²]) land withdrawal was formalized between the AEC and BLM on December 6, 1968, under Public Land Order #4338. Subsequent additional withdrawals were made for emplacement borings UC-3 and UC-4 on December 2, 1969, under Public Land Order #4748. The withdrawals for the UC-3 and UC-4 sites are larger than the UC-1 site by about 1.30 km² (0.5 mi²). Other permits and easements were obtained for exploratory borings, weather stations, and miscellaneous support facilities such as Contract AT(26-1)552. This contract was negotiated

with Nye County for a 91.4-meter (m) square (300-foot [ft] square) area on an aircraft parking apron at the Tonopah Airport. The CNTA consisted of about 20 separate properties (AEC, 1974).

Under the direction of the AEC, CNTA was operated and maintained by Holmes and Narver (H&N) and its subcontractors although other federal agencies assisted in the operations, including:

- National Environmental Research Center (formerly the U.S. Public Health Service)
- Air Resources Laboratory (formerly the U.S. Weather Bureau)
- U.S. Geological Survey
- National Oceanic Survey

Scientific programs at CNTA, implemented by AEC subcontractors, were jointly administered by Lawrence Livermore National Laboratory (LLNL) and Los Alamos National Laboratory (LANL).

The Project Faultless facilities consisted of a Base Camp and a separate control point area (Figure 2-1). Originally, the Base Camp was a temporary H&N support camp, but during 1968 and 1969 after the Faultless project, the Base Camp and the Control Point areas were improved for reuse. Selected facilities were purchased from H&N; new buildings were constructed; and other buildings were replaced with portable trailers from the NTS (AEC, 1974).

Emplacement boring UC-1 was completed about 35 km (25 mi) north of Base Camp at Nevada State coordinates (central zone) North 1,414,340 feet, East 629,000 feet. The boring was advanced through about 700 m (2,300 ft) of alluvium and penetrated a confined aquifer in volcanic tuff. The two additional emplacement borings (UC-3 and UC-4) were also completed about 4.8 km (3 mi) to the north (UC-4) and south (UC-3) of UC-1. Emplacement boring UC-3 and additional support facilities were to be used for Project Adagio, but that project was never completed. In addition, several other structures were built for the Adagio project, including a new control point, an airstrip, an access road system, a recording trailer park, cableways, and a ground zero area. Similarly, emplacement hole UC-4 was to be used for a future project (unnamed), but that project was also never completed (AEC, 1974).

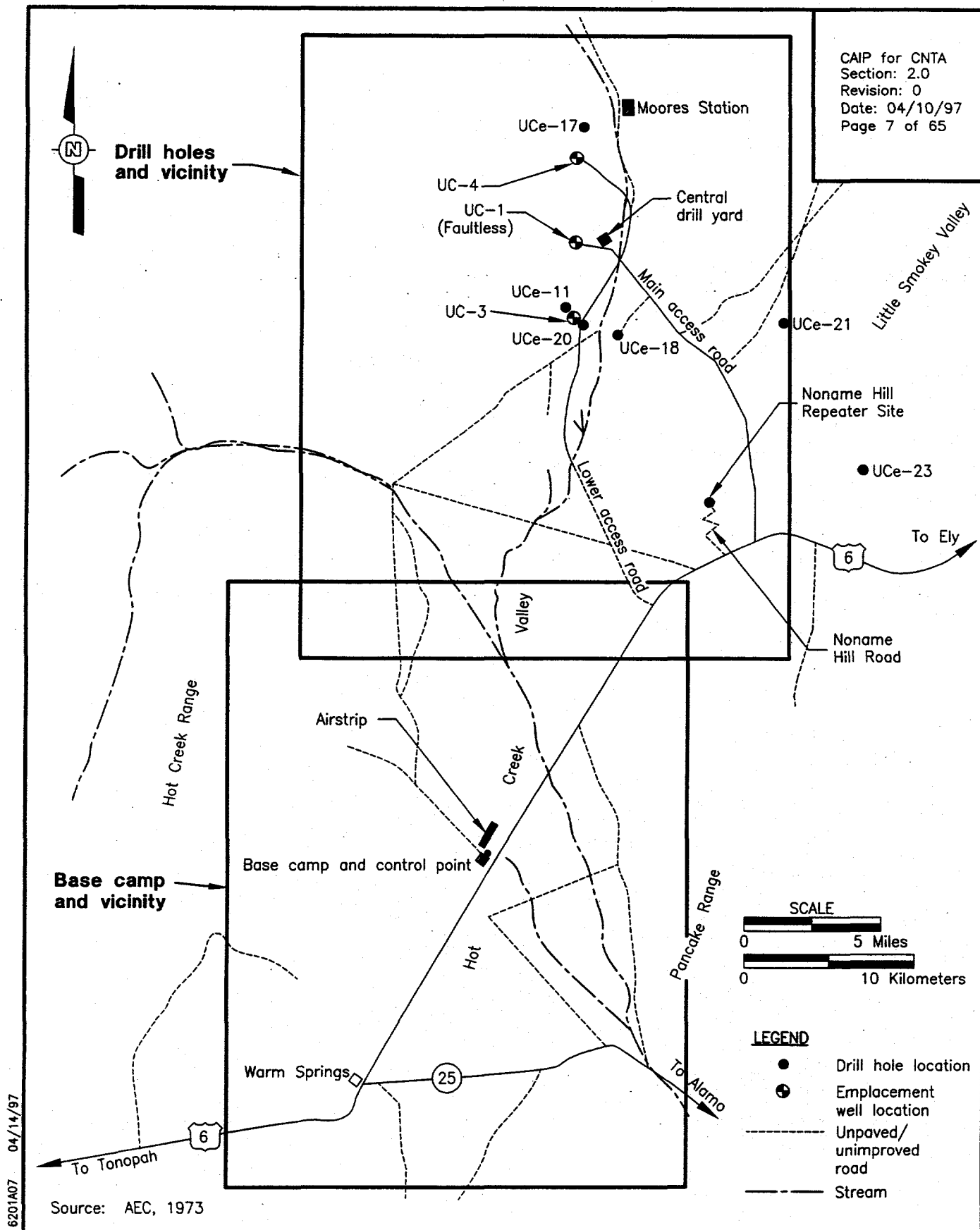


Figure 2-1
Site Map, Central Nevada Test Area, Nye County, Nevada

Large-diameter, deep boreholes were completed for the emplacement borings. Boring UC-1 is a 1.8-m (72-inch [in.]) to 1.0-m (42-in.) diameter borehole advanced to 998 m (3,275 ft) below grade. It is cased from grade to about 122 m (400 ft) below grade with 1.2-m (48-in.) and 0.27-m (10.75-in.) casing. Boring UC-3 is a 3-m (120-in.) diameter borehole advanced to 1,477 m (4,846 ft) below grade. UC-3 is cased from grade to 1,458 m (4,782 ft) below grade with 1.3-m (54-in.) casing. Boring UC-4 is a 3.6-m (144-in.) to 3-m (120-in.) diameter borehole advanced to 1,676 m (5,500 ft) below grade. UC-4 is cased with 3.1-m (122-in.) casing from grade to 127 m (415 ft) below grade and is uncased from that depth to the bottom (Fenix and Scisson, 1973).

In addition to the three emplacement borings completed at CNTA, several other boreholes were completed for pre-shot and post-shot hydrologic testing and geologic exploration (Figure 2-2). Eight boreholes were completed to install downhole instruments for the Faultless event; eight borings were completed for hydrologic testing; and 15 boreholes were completed for geologic exploration. Three additional boreholes were completed for post-shot hydrologic and geologic testing. The depths of the test boreholes and wells ranged from about 94 m (307 ft) to 1,986 m (6,515 ft) (Fenix and Scisson, 1973).

The Faultless nuclear device was detonated on January 19, 1968, at a depth of 975.4 m (3,200 ft) in emplacement boring UC-1 (DOE, 1994c). The shot affected both the volcanic unit at the working point and the overlying surficial alluvium. The detonation produced an asymmetric collapse graben bounded by several fractures and scarps evident in the surface ground zero (SGZ) area. Surface fractures range up to 2,700 m (9,000 ft) long. The surface expression of the graben is irregular in comparison to the typical, shallow, cone-shaped or semicircular crater generally characteristic of subsurface detonations that alter the SGZ.

The SGZ area is now a subsided block bounded by fresh fault scarps that outline a nearly triangular area. Typical maximum vertical fracture displacements at SGZ are about 4 m (15 ft), and horizontal offsets are about 1 m (3 ft). Some of the displacement occurred at the time of detonation, with additional displacement related to post-shot subsidence. The total surficial area of subsidence is about 371.6 m² (4,000 ft²). Seismic data from the test were approximately the same as predicted by the Environmental Research Corporation (DRI, 1988).

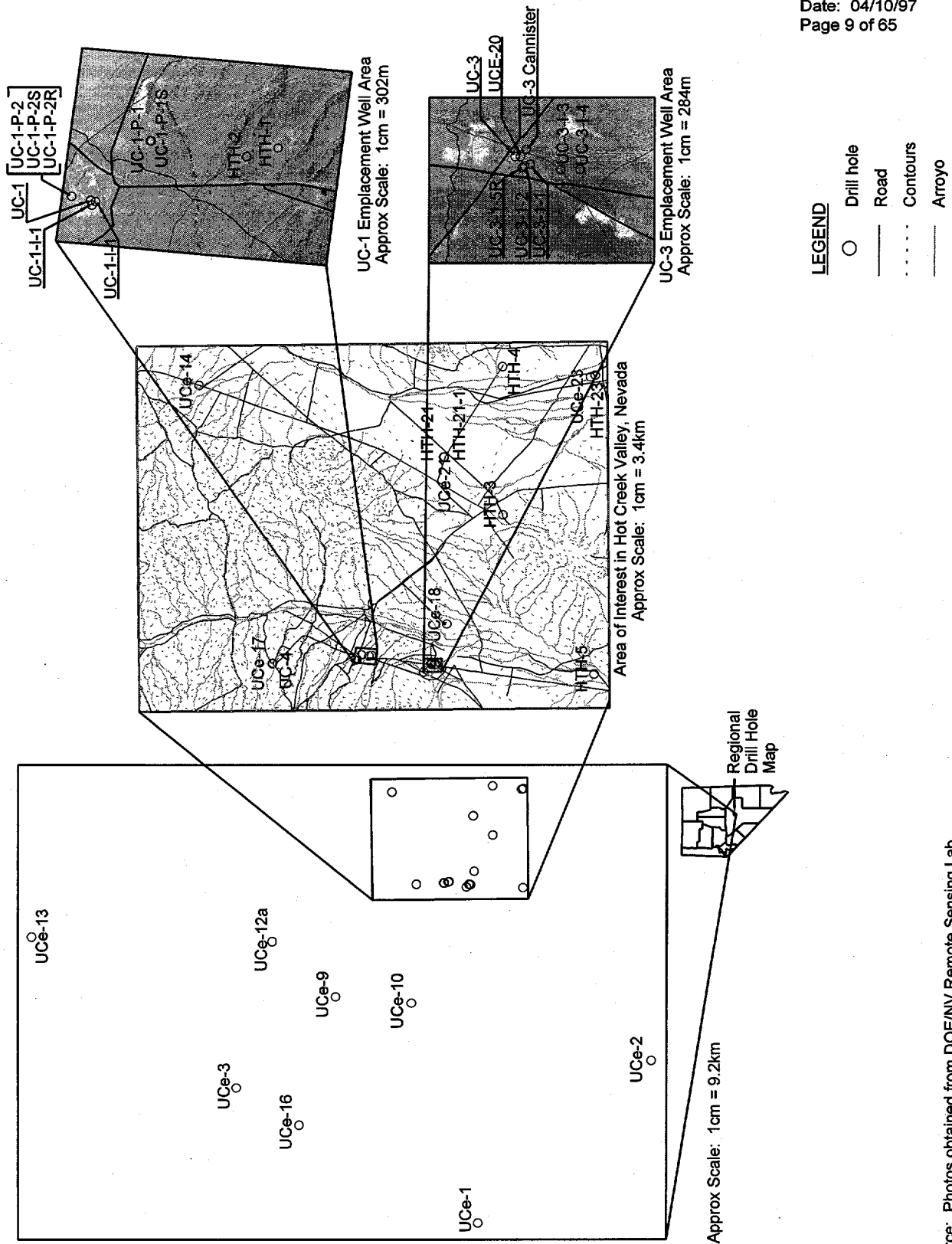


Figure 2-2
Boring and Well Locations, Central Nevada Test Area

The CNTA site was decommissioned in 1973, and demobilization of the site commenced. All drilling sites, equipment, support facilities, and materials, including radiologically contaminated materials, were addressed in the site demobilization. In addition, areas disturbed by AEC operations were delineated. The DOE Nevada Operations Office retained control of some limited areas, while the BLM and the U.S. Air Force assumed responsibility of most of the area. Most borings and wells were abandoned, but five wells were left open for the CNTA Long-Term Hydrologic Monitoring Program (LTHMP) (AEC, 1973, 1974).

The DOE, LLNL, and LANL completed several pre-shot and post-shot research projects at the CNTA, including post-shot radiological safety surveys. A radiological survey was completed by Eberline in 1973 prior to demobilization and restoration of the CNTA site. The survey detected only background radioactivity (Eberline, 1973). A second radiological and hazardous waste survey was completed by Reynolds Electrical & Engineering Co., Inc. (REECo) in 1986 at several DOE facilities. Again, at CNTA, only background radiation was detected, but chromium (from a drilling mud additive) was detected in an uncovered drilling mud pit (REECo, 1986). Based on the two radiological surveys at CNTA, it appears the radionuclides from the Faultless event were contained within the shot cavity during the detonation, and post-shot drilling operations did not cause the release of any radionuclides.

2.2 Corrective Action Sites

The FFACO lists both surface (soil) and subsurface (groundwater) CASs at CNTA (FFACO, 1996). Table 2-1 provides a listing of the identified surface CASs on the CNTA site.

The FFACO lists the following subsurface CASs:

- Faultless Event Shot Cavity (UC-1 Cavity)
- Emplacement Well UC-3
- Emplacement Well UC-4

Each of the surface and subsurface CASs is identified by a specific CAS number (Table 2-1). Five of the surface CASs that were listed in the FFACO but are not included as part of this CAIP will be discussed briefly in the following sections. The subsurface CASs will be addressed in a separate CAIP. All remaining surface CASs are discussed in Section 2.3 and will be investigated under this CAIP using the ESC methodology.

Table 2-1
Corrective Action Sites

Corrective Action Site Number	Corrective Action Site Description	General Location or Event
Surface Sites (CAU No. 417)		
58-07-01*	Decon Facility Pit	West of 58-09-01
58-09-01	Central Mud Pit	East of UC-1
58-09-02	Mud Pit	Southwest of 58-09-01
58-09-03	Mud Pits (5)	UC-4
58-09-04	Mud Pit/Borrow Area	UC-1 (HTH-1 Well)
58-09-05	Mud Pits (3)	UC-1 Surface GZ
58-09-06	Mud Pits (5)	UC-3
58-10-01	Shaker Pad Area	Northeast of UC-3
58-10-02	Shaker Pad Area	North of UC-4
58-19-01	Scrap and Trash Dump	West of UC-3 RTP
58-35-01	Burn Area	West of 58-09-01
58-44-01	Drilling Mud/Grout Piles (2)	West of 58-09-01
58-44-02	Drilling Mud/Grout Piles (2)	West of 58-09-01
58-44-03	Drill Mud/Grout Spill Area	Southeast of UC-3
58-44-04	Drill Mud/Grout Spill Area	Southwest of UC-3
58-98-01**	Waste Pile (Drums, Filters, etc.)	West of UC-3
58-98-02**	Waste Pile (Drums, Filters, etc.)	South of UC-3
58-98-03**	Waste Pile (Drums, Filters, etc.)	Adjacent to 58-09-02
58-98-04**	Waste Pile (Metal, Cable, etc.)	Adjacent to 58-44-03
58-99-01	Protruding Pipes (2)	North of UC-3
Subsurface Sites (CAU No. 443)		
58-30-01	Emplacement Well UC-3	UC-3
58-30-02	Emplacement Well UC-4	UC-4
58-57-001	UC-1 Cavity	Faultless

*Decon Facility Pit not addressed per Section 2.2.1

**CAS sites not addressed in this CAIP per Section 2.2.2

2.2.1 Decontamination Facility Pit at UC-1

A radiological decontamination (decon) facility pit (CAS 58-07-01) was constructed at UC-1 (AEC, 1974). The decon facility (Figure 2-3) was used to decontaminate downhole drilling equipment and other instruments potentially subjected to post-shot radioactivity. The 1973 Eberline survey (Section 2.1) did not detect any radioactivity within the pit (Eberline, 1973). The surrounding fence was then removed, and the pit was backfilled (AEC, 1974). The pit location west of the UC-1 Central Mud Pit is depicted in Figure 2-4. Because the 1973 Eberline survey did not detect any radiological contamination, the pit will not be addressed in the CNTA CAIP.

2.2.2 Waste Piles

An Environmental Restoration (ER) "housekeeping" site is defined as any disposed waste and/or any facility, location, or structure where waste was disposed of or contained. Designation as an ER housekeeping site, however, does not imply classification according to any regulatory framework. An ER housekeeping site may contain one or more waste types including nonhazardous, recyclable, hazardous, radioactive, mixed, or unknown.

During the February 1996 site reconnaissance conducted by DOE and IT, four waste piles were identified at CNTA:

- Three sites near UC-3 (labeled CAS 58-98-01, CAS 58-98-02, and CAS 58-98-04)
- One site near the UC-1 Central Mud Pit (labeled CAS 58-98-03)

The waste piles are composed of metallic debris, heavy equipment air filters, crushed aerosol cans, and other general refuse. The sites range in size from 9 m x 3 m x 1.5 m (30 ft x 10 ft x 5 ft) to 46 m x 6 m x 1 m (150 ft x 20 ft x 4 ft). As detailed in the FFACO, investigation of the four waste pile CASs at CNTA will be completed under the separate ER housekeeping sites program (FFACO, 1996).

2.2.3 Subsurface CASs

The subsurface CASs listed in the FFACO will be addressed in a separate CAIP.

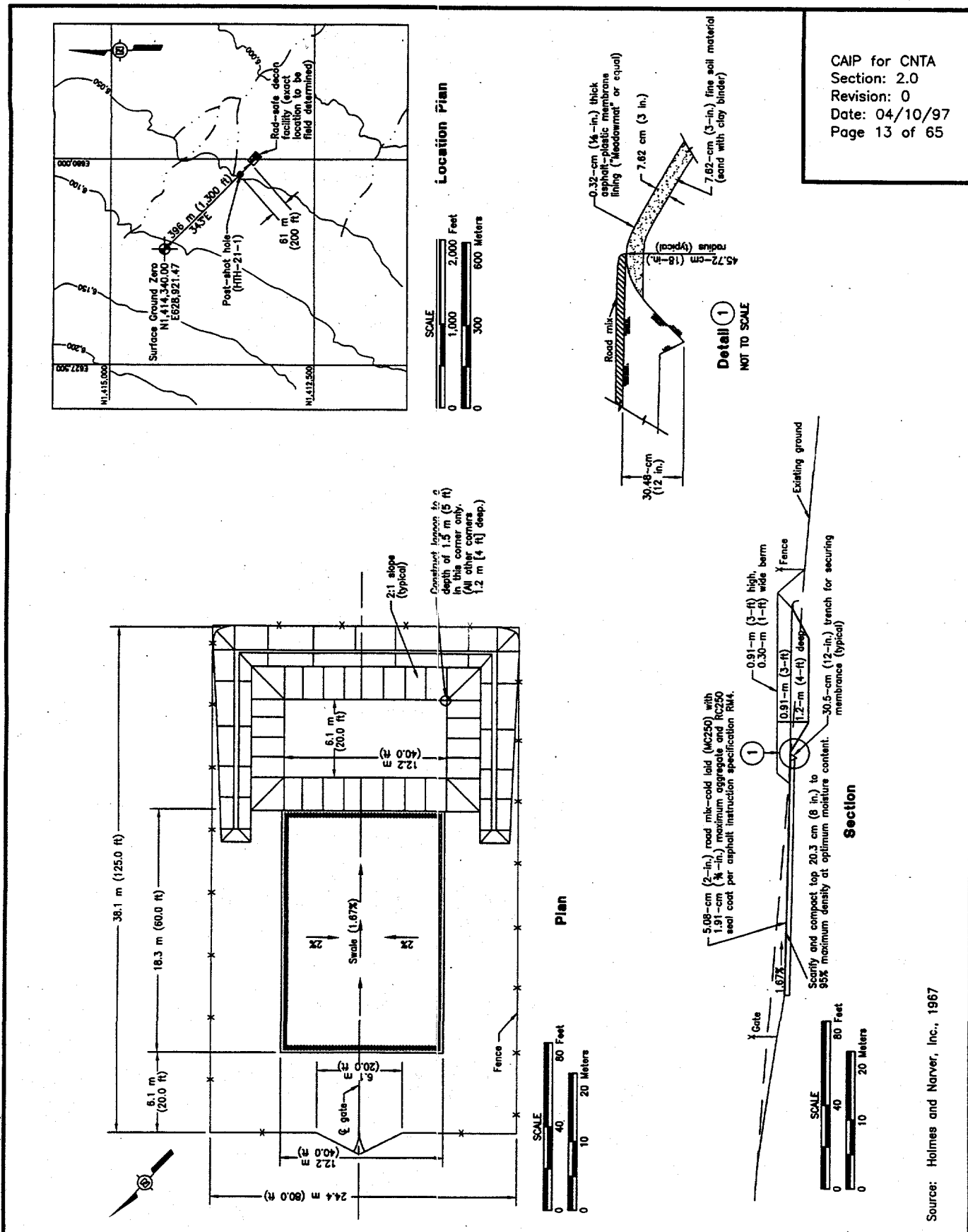
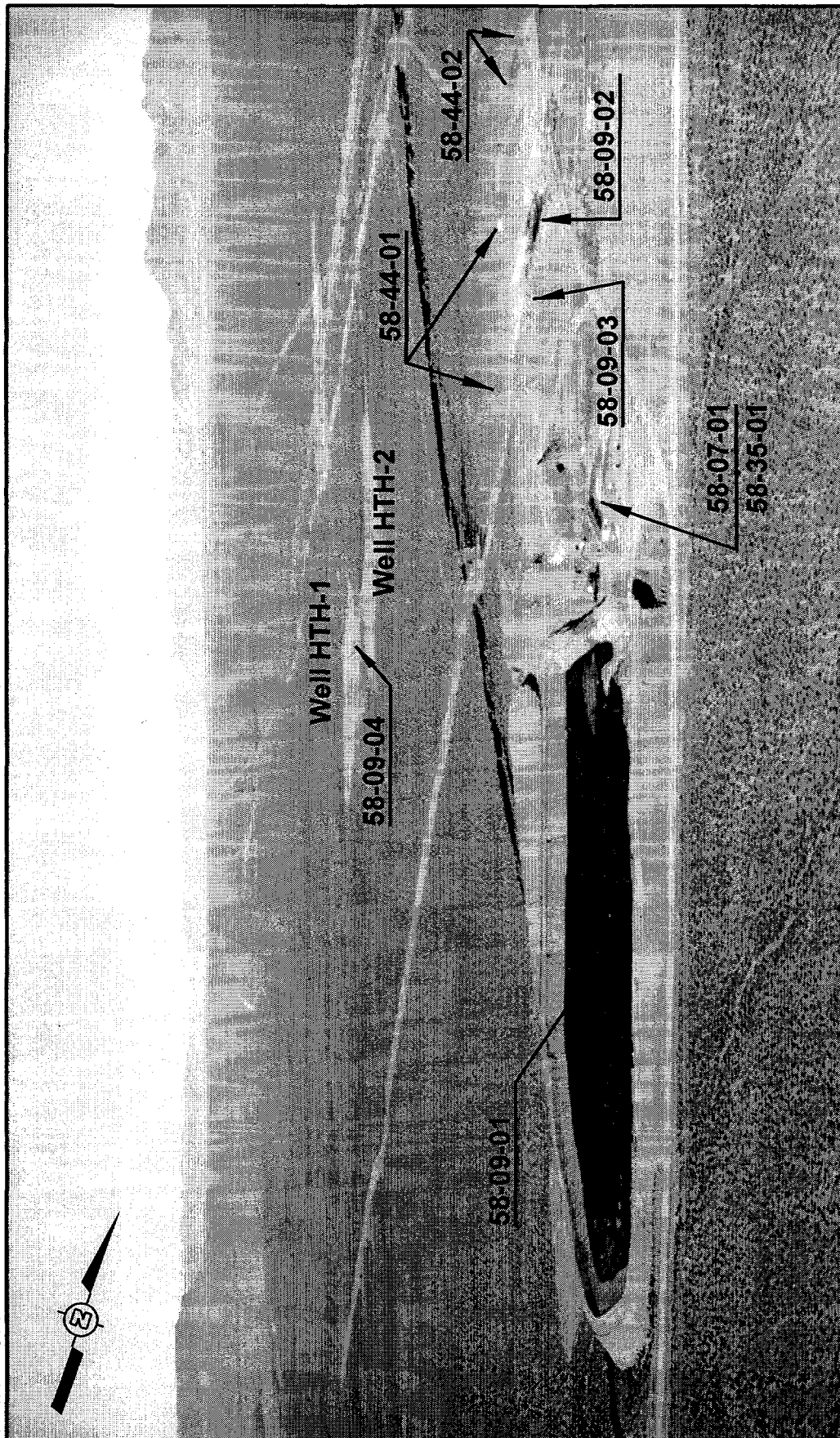


Figure 2-3
Decontamination Facility Pit at UC-1, Plan and Section,
Central Nevada Test Area

**CORRECTIVE ACTION SITES**

58-07-01	Decon Facility Pit	58-09-04	Mud Pit/Borrow Area
58-09-01	Central Mud Pit	58-35-01	Burn Area
58-09-02	Mud Pit	58-44-01	Drilling Mud/Grout Piles (2)
58-09-03	Mud Pits (5)	58-44-02	Drilling Mud/Grout Piles (2)

Note: View is looking to the South West
 Source: Photos obtained from DOE/NV Remote Sensing Lab
 Photo date: ca. 1968

Figure 2-4
Corrective Action Sites in the Vicinity of the
Central Mud Pit, Central Nevada Test Area

2.3 Potential Site Contamination

The discussion of potential site contamination in this section has been compiled from the following information sources:

- The 1973 Eberline radiological survey (Eberline, 1973)
- The February 1996 DOE/IT site reconnaissance visit
- DOE/IT review of historical and recent aerial photographs of CNTA taken by the RSL (RSL, 1968; RSL, 1993)

2.3.1 Potential Soil Contamination

Each of the potential soil contamination CASs addressed in this investigation plan is detailed in the following text.

2.3.1.1 Central Mud Pit

The Central Mud Pit (CAS 58-09-01), located just southeast of UC-1, was used to store drilling mud during the drilling of emplacement holes UC-3 and UC-4. During the February 1996 DOE/IT site reconnaissance, the pit was measured at approximately 168 m x 131 m (550 ft x 430 ft). Atomic Energy Commission documents indicate that the pit was not covered or diked (AEC, 1974), but 1993 aerial photographs show that the pit is fully bermed (Figure 2-4). No plans or engineering drawings of the pit could be obtained during the historical document review process.

2.3.1.2 Additional Mud Pits at UC-1, UC-3, and UC-4

Additional Mud Pits at UC-1

Four mud pits, smaller than the Central Mud Pit at UC-1, and one pit or borrow area were observed near UC-1 during the February 1996 site reconnaissance. These pits are designated by the following CAS identifications and labels:

- 58-09-02 (Pit 1A)
- 58-09-04 (Pit 1B)
- 58-09-05 (Pits 1C, 1D, 1E)

Mud Pit 1A is located about 183 m (600 ft) southwest of the Central Mud Pit at UC-1. The pit is a slight depression and measures approximately 9 m x 8 m (29 ft x 25 ft) and is bermed on the east side. Mud Pit 1B, possibly a borrow area and not a mud pit, was observed near UC-1 and

adjacent to Well HTH-1. The feature measures 49 m x 46 m (160 ft x 150 ft) and is bermed on the north, south, and west sides (Figure 2-4).

Mud Pit 1C (CAS 58-09-05) is located downslope from and to the east of UC-1, about halfway to the Central Mud Pit. Pit 1C is a slight, nearly semicircular depression which measures approximately 91 m x 53 m (300 ft x 175 ft). A fresh scarp from the Faultless event divides the pit into two nearly equal areas (Figure 2-5). Sparse vegetation is growing within the pits.

Two additional areas which appear to be mud pits, labeled Pit 1D and Pit 1E, are evident near Pit 1C in historical aerial photographs (RSL, 1968). The pits measure about 183 m by 137 m (600 ft by 450 ft) and 137 m by 91 m (450 ft by 300 ft). Although backfilling was not field-verified during the February 1996 DOE/IT site reconnaissance, the pits appear backfilled in recent aerial photographs (RSL, 1993). Corrective Action Site 58-09-05 includes Pits 1D and 1E and Pit 1C discussed above.

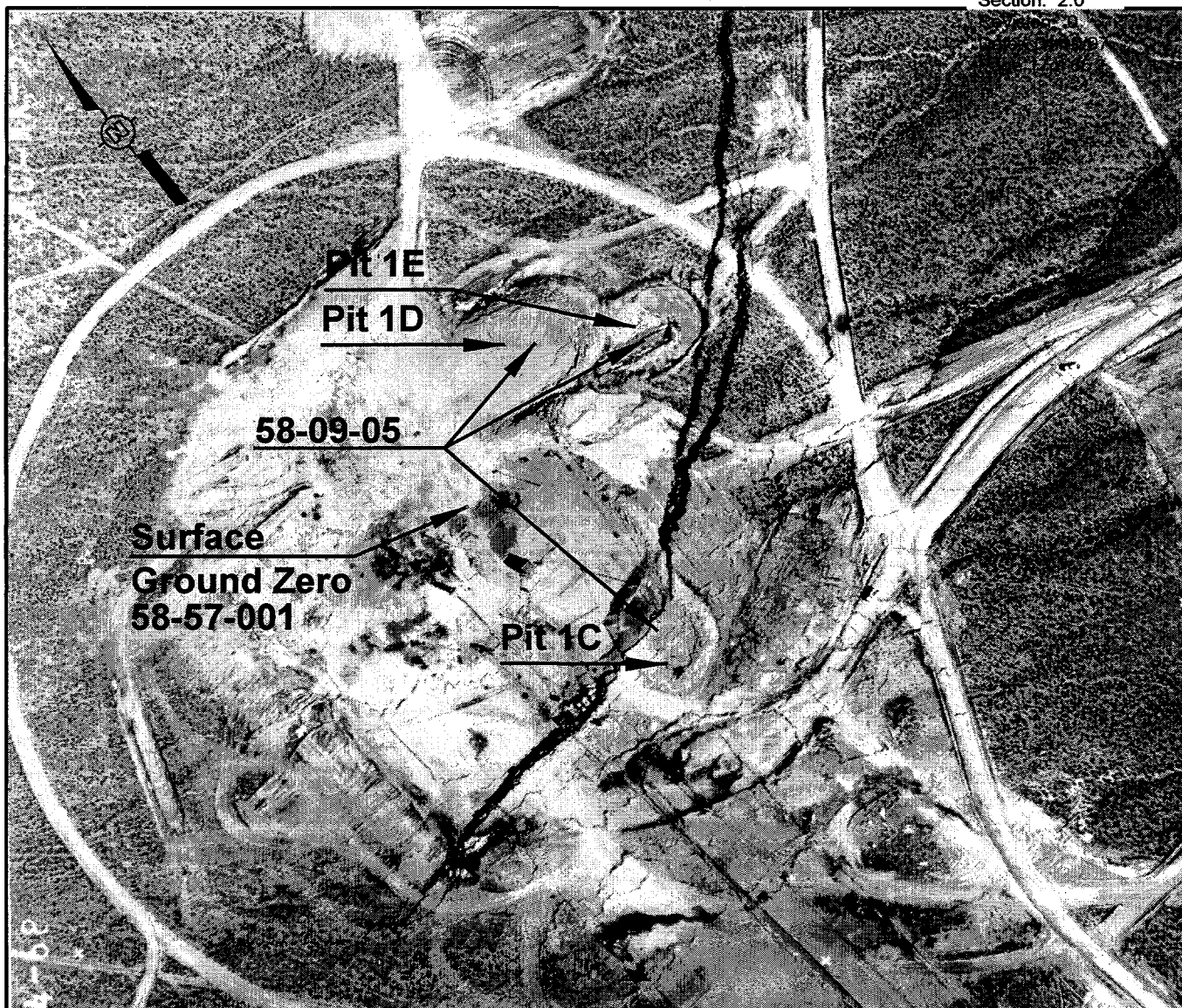
Mud Pits at UC-3 and UC-4

The construction of mud pits at emplacement borings UC-3 and UC-4 was relatively well-documented with engineering plans completed by Fenix and Scisson (1968). The plans for the UC-3 mud pits are included in Appendix B.

The plans indicate:

- Five mud pits at UC-3 (CAS 58-09-06), labeled Pits 3A through 3E
- Five mud pits at UC-4 (CAS 58-09-03), labeled Pits 4A through 4E

The mud pits at unused emplacement holes UC-3 and UC-4 (Figures 2-6, 2-7, and 2-8) were backfilled during the CNTA restoration activities in 1974 (AEC, 1974). The pits at UC-3 were apparently used for disposal of nonflammable scrap and nonsalvageable items during site restoration activities in 1973 (AEC, 1973; AEC, 1974). All of the pits at UC-3 and four of the five pits at UC-4, however, were observed to be backfilled during the February 1996 site reconnaissance.



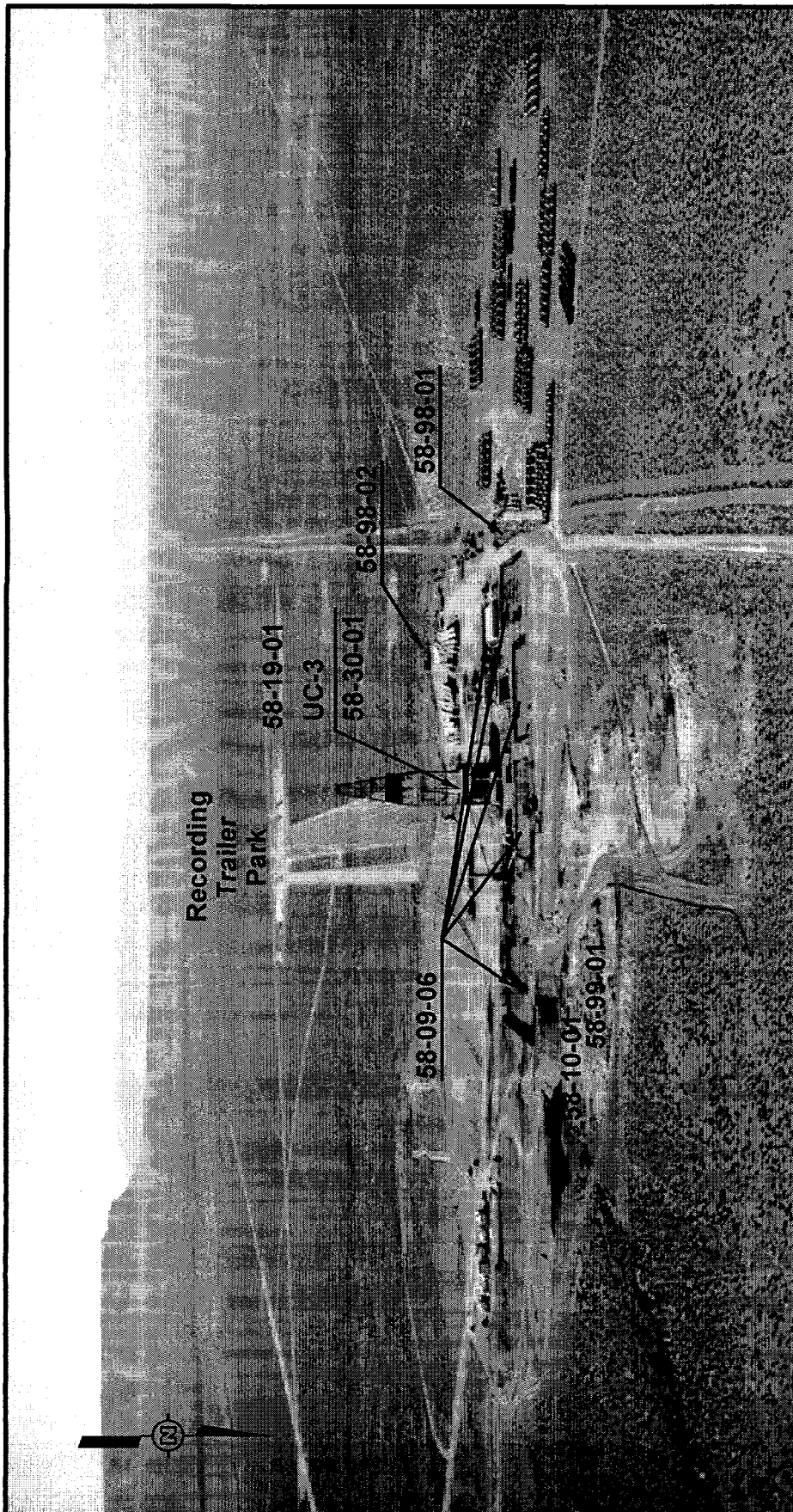
CORRECTIVE ACTION SITES

58-09-05	Mud Pits (3)
58-57-01	UC-1 Event Cavity

APPROX SCALE: 1cm = 57m
1in = 475ft

Source: Photos obtained from DOE/NV Remote Sensing Lab
Photo date: ca. 1968

Figure 2-5
Mud Pits at UC-1, Central Nevada Test Area

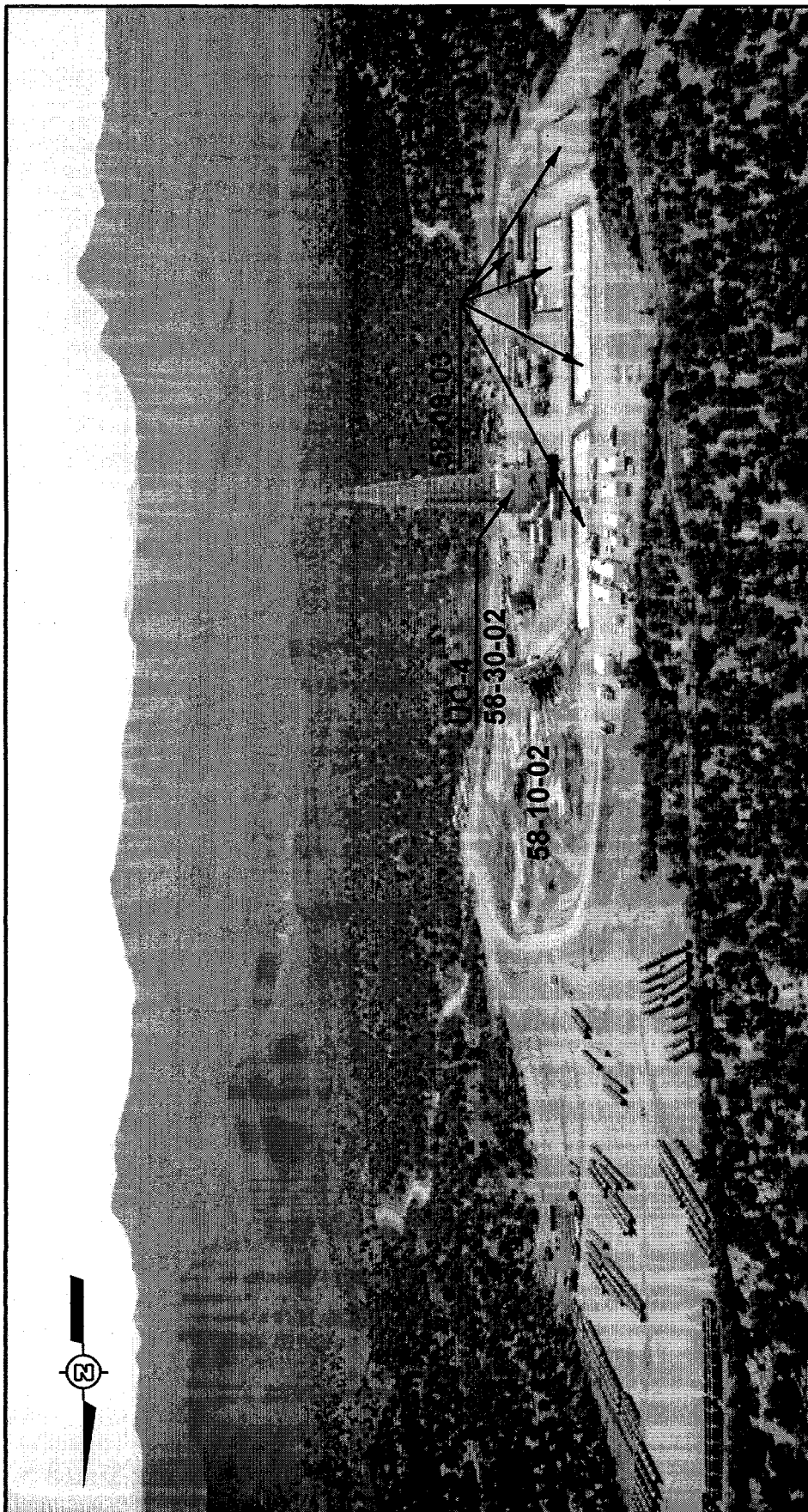
**CORRECTIVE ACTION SITES**

58-09-06	Mud Pits (5)
58-10-01	Shaker Pad Area
58-19-01	Scrap and Trash Dump Area
58-30-01	Emplacement Well UC-3
58-98-01	Waste Pile (Drums, Filters etc.)
58-98-02	Waste Pile (Drums, Filters etc.)
58-99-01	Protruding Pipes (2)

Note: View is looking to the South

Source: Photo obtained from DOE/NV Remote Sensing Lab
Photo date: ca. 1988

Figure 2-6
Corrective Action Sites in the Vicinity of the
UC-3 Emplacement Well, Central Nevada Test Area



CORRECTIVE ACTION SITES

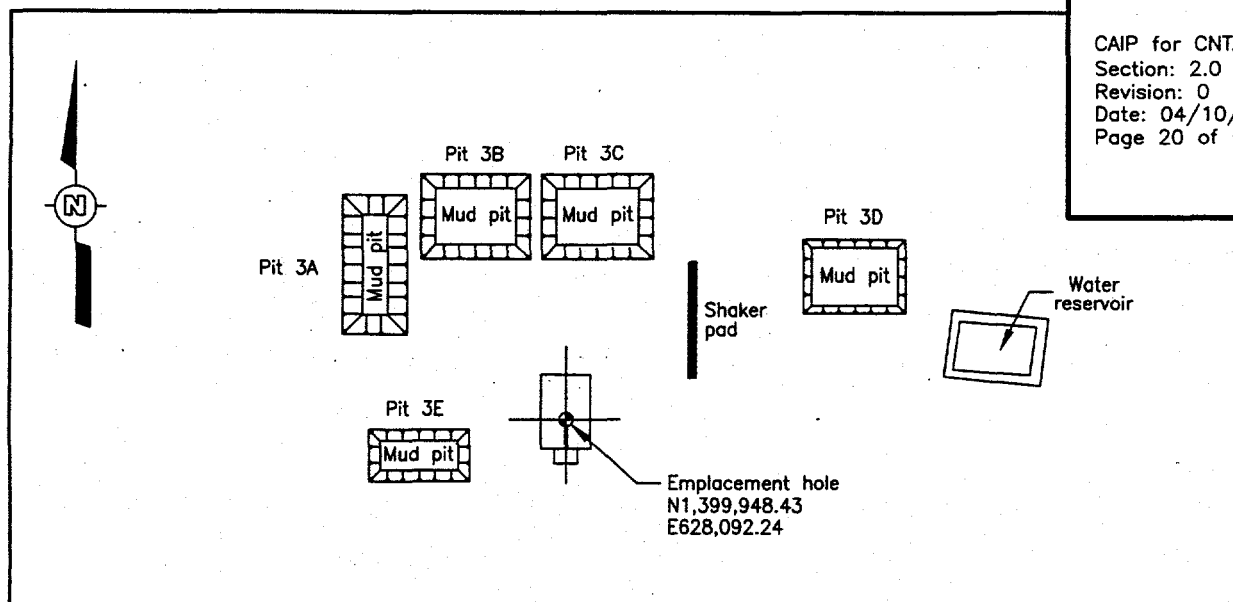
58-09-03	Mud Pits (5)
58-10-02	Shaker Pad Area
58-30-02	Emplacement Well UC-4

Note: View is looking to the East

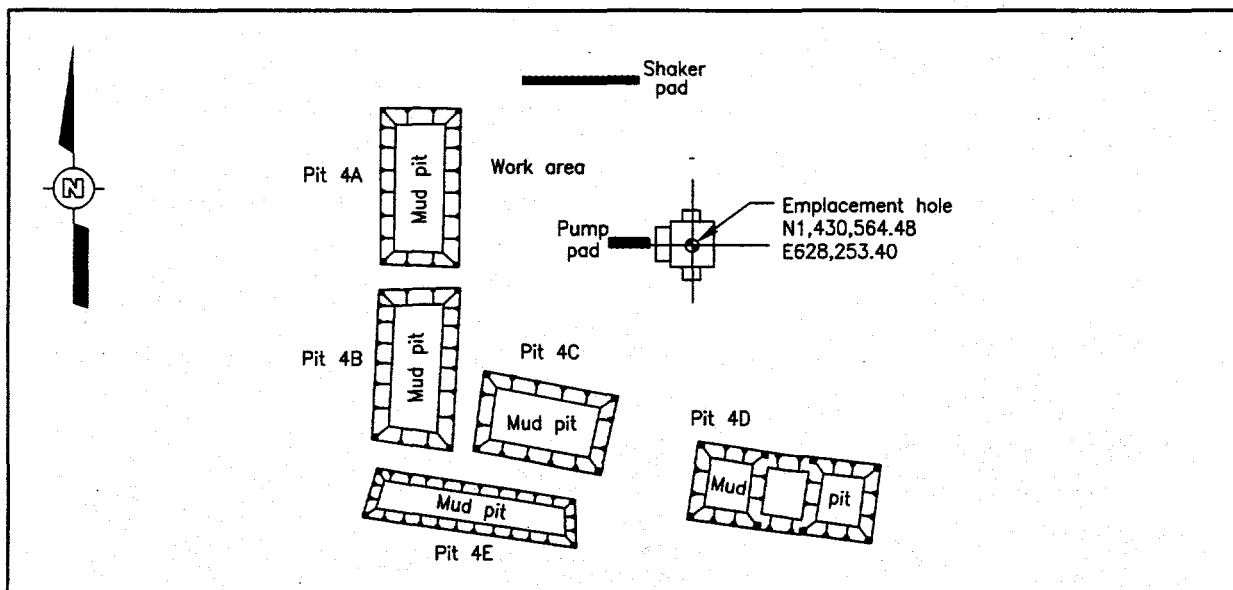
Source: Photo obtained from DOE/NV Remote Sensing Lab

Photo date: ca.1968

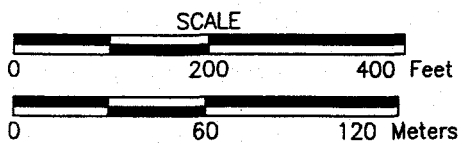
Figure 2-7
Corrective Action Sites in the Vicinity of the
UC-4 Emplacement Well, Central Nevada Test Area



Drill Site -- UC-3
 Pad elevation = 1,755 m (5,759 ft)
 Hole diameter = 137-cm (54-in.) id with 295-cm (116-in.) chamber
 Hole depth = 1,448 m (4,750 ft)



Drill Site -- UC-4
 Pad elevation = 1,993.4 m (6,540 ft)
 Hole diameter = 137-cm (54-in.) id with 295-cm (116-in.) chamber
 Hole depth = 1,494 m (4,900 ft)



Source: Fenix & Scisson, 1968 and AEC, 1973, and aerial photographs

Figure 2-8
UC-3 and UC-4 Mud Pits, Central Nevada Test Area

2.3.1.3 Shaker Pad Areas

Shaker pads are evident at unused emplacement borings UC-3 and UC-4 in historical aerial photographs (Figures 2-6, 2-7, and 2-8) (RSL, 1968). Shakers (shale shakers) are conveyor/vibration sorting machines installed on pads at mud rotary drilling sites to separate drill cuttings from drilling mud. The shakers force drill cuttings to accumulate in an outfall area while drilling mud is separated and pumped back to mud pits for storage and reuse. As drill cuttings accumulate, mud is often spilled onto the ground or pooled around the shaker pad.

A substantial amount of pooled mud and water released from the UC-3 and UC-4 shaker pads is evident in the 1968 RSL aerial photographs. The spilled mud and water spread to the northeast of both pads. The shaker pad at UC-3 is labeled CAS 58-10-01, and the pad at UC-4 is labeled CAS 58-10-02.

2.3.1.4 Burn Area

An area possibly used for refuse burning is evident at the site near some degraded asphalt about 31 m (100 ft) west of the UC-1 Central Mud Pit. The Suspect Burn Area, labeled CAS 58-35-01, was observed during the February 1996 site reconnaissance. The location of this site corresponds with the Decontamination Facility Pit evident in the 1968 RSL aerial photographs. The use of this site may be directly associated with the UC-1 Decontamination Facility Pit because the apparently burned material appears to be black plastic sheeting similar to lining which is evident in the 1968 RSL aerial photographs of pit construction. Construction drawings of the pit (Figure 2-3) indicate that the pit was lined with an asphalt-plastic membrane. A large portion of the sheeting is buried and covered with vegetation. The exposed portion of the sheeting is 9 m x 6 m (30 ft x 20 ft) and is black and blistered with peeled and curling green-colored edges. Solar decomposition of the unburied plastic sheeting may contribute to its burned appearance.

2.3.1.5 Scrap and Trash Dump

A scrap and trash dump, labeled CAS 58-19-01, was located west of the Recording Trailer Park and south of UC-3 (Figure 2-6). This dump was used for disposal of nonflammable scrap and nonsalvable items during site restoration, and the dump was then backfilled (AEC, 1973; 1974). Because the dump was backfilled, its exact location could not be determined during the February 1996 site reconnaissance.

2.3.1.6 Drilling Mud/Grout Piles and Drill Mud/Grout Spill Area

Four small drilling mud/grout piles consisting of a light gray material were observed just west of the UC-1 Central Mud Pit during the February 1996 site reconnaissance (Figure 2-9). Two pile areas are labeled CAS 58-44-01, and two areas are labeled CAS-58-44-02. The piles range in size from 2.4 m (8 ft) in diameter and 1 m (3 ft) high to 6 m x 6 m x 1 m (20 ft x 20 ft x 3 ft).

Two spill areas (labeled CAS 58-44-03 and CAS 58-44-04) just southeast and southwest of UC-3 are evident in the 1993 RSL aerial photographs (see Figure 2-9).

During the February 1996 site reconnaissance, the spill area to the southeast of UC-3 labeled CAS 58-44-03 was measured at about 283 m x 55 m (930 ft x 180 ft). This elongated spill area contains small amounts of partially buried metal and debris. Vegetation in the area is sparse. The spill area to the southwest of UC-3 was not visited in February 1996.

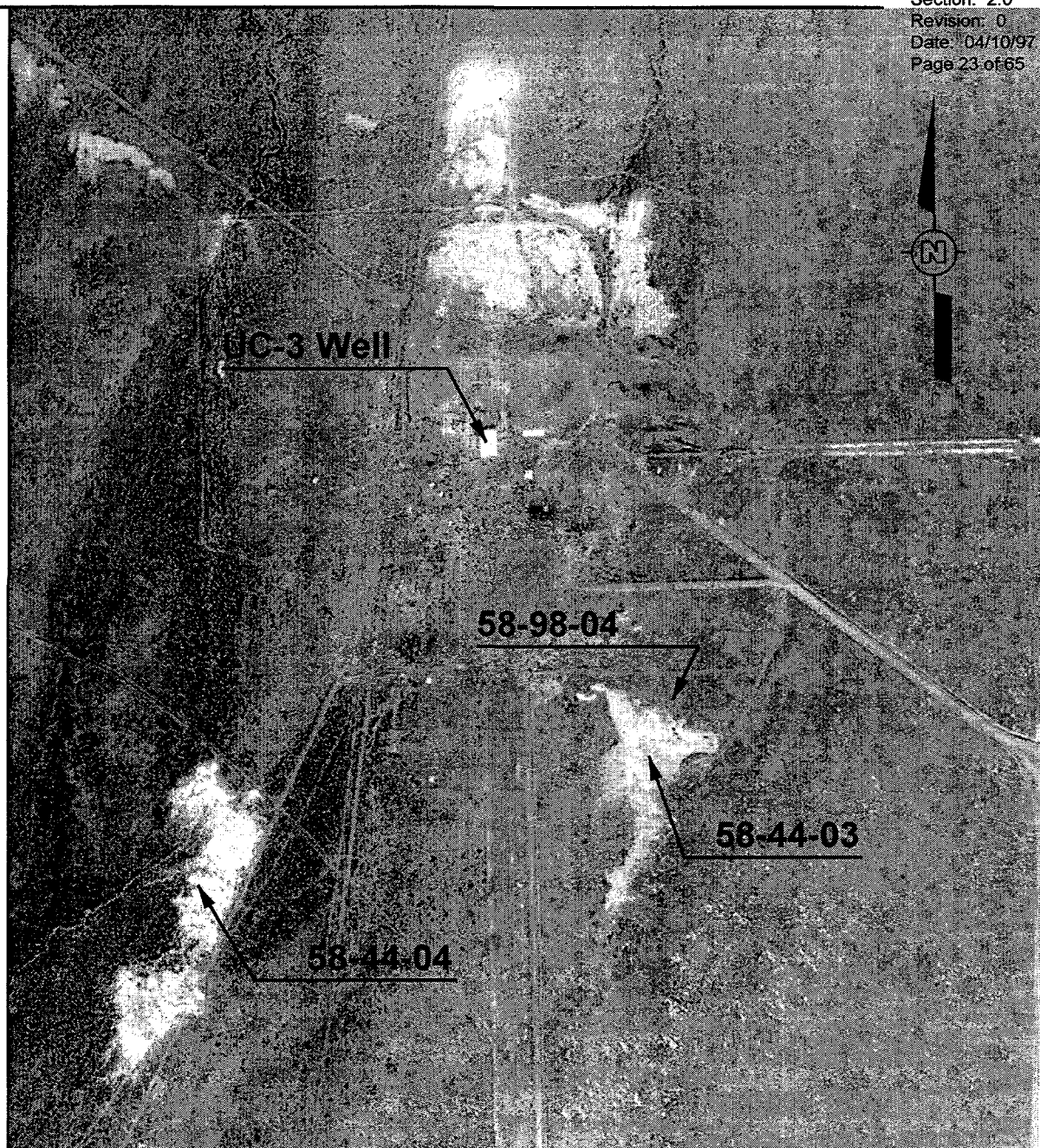
2.3.1.7 Protruding Pipes

During the recent CNTA site reconnaissance, two unidentified steel pipes were observed near UC-3. The pipes are 5 centimeters (cm) (2 in.) and 10 cm (4 in.) in diameter and are located about 0.6 m (2 ft) apart. Uncapped and open to grade, the pipes extend about 0.5 m (1.5 ft) and 1 m (3 ft) below grade. Some liquid was evident inside the larger pipe. This site is labeled CAS 58-99-01.

2.4 Investigative Background

In addition to the 1973 radiological survey conducted by Eberline, two limited sampling and analysis events have been conducted at CNTA to evaluate potential chemical (nonradiological) contamination. The first was a hazardous waste installation assessment conducted by REEC Co in 1986 (REEC Co, 1986). The second was conducted by DOE and IT in 1995 (DOE, 1995). These two sampling and analysis events are discussed below.

During the 1986 REEC Co survey, the Central Mud Pit was found to be covered with a "dried oily-looking crust." Samples of the "oily dirt" and "oily crust" were collected from the mud pit and analyzed (REEC Co, 1986). The analytical data indicated the drilling fluids consisted of a bentonite drilling mud with diesel fuel and chrome lignosulfonate additives. The 1986 REEC Co data are listed in Table 2-2. The samples collected at the mud pit contained about 8 milligrams per liter (mg/L) of chromium as determined by the Extraction Procedure Toxicity (EP-TOX)



CORRECTIVE ACTION SITES

APPROX SCALE: 1cm = 68m
1in = 266ft

58-44-03	Drill Mud/Grout Spill Area
58-44-04	Drill Mud/Grout Spill Area
58-98-04	Waste Pile (Metal, Cable etc.)

Source: Photos obtained from DOE/NV Remote Sensing Lab

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Figure 2-9
Additional Corrective Action Sites in the Vicinity of the
UC-3 Emplacement Well, Central Nevada Test Area

Table 2-2
Analytical Data from the 1986 REECo Survey

Sample Location	Sample Number	Parameter	EP Toxicity		Halocarbon	
			Detected (mg/L) ^a	Hazardous ^b (mg/L)	Detected (μg/kg) ^c	Hazardous (kg) ^d
Runoff Ditch	1	Lead	0.3	5.0		
Central Mud Pit	2 (oily crust)	Chromium	7.9	5.0		
	2 (oily dirt)	2-Butanone			37	1,000
		Chromium	8.1	5.0		

^a Milligram(s) per liter

^b Hazardous concentrations as listed in 40 Code of Federal Regulations CFR 261.24

^c Microgram(s) per kilogram

^d Hazardous quantity as listed in 40 CFR 261.33

EP = Extraction procedure

REECo = Reynolds Electrical & Engineering Co., Inc.

Source: REECo, 1986

method. The chromium is probably from chrome lignosulfonate, a drilling mud thinner used to minimize drilling water loss (DRI, 1988). Because only two samples were collected in the 1986 REECo survey and both were collected at the edge of the pit, the extent of the chromium was not determined.

The 1995 DOE sampling and analysis event entailed sampling the Central Mud Pit, the uncovered mud pit at UC-4, and a drainage ditch in the vicinity of UC-1 (DOE, 1995). The samples were analyzed for total petroleum hydrocarbon (TPH) and Toxicity Characteristic Leaching Procedure (TCLP) extractable metals. The analytical results for the samples (Table 2-3) indicate that both the Central Mud Pit and the uncovered mud pit at UC-4 contain concentrations of TPH and TCLP chromium that exceed *Resource Conservation and Recovery Act* (RCRA) regulatory standards (40 CFR 261).

2.5 Waste Inventory

Based on available historical information and the analytical data from the 1986 REECo and 1995 DOE sampling events, the only waste materials suspected to be at CNTA are TPH and chromium associated with the mud pits, shaker pad areas, and drilling mud/grout piles. There currently is insufficient information available to estimate the quantity of waste present at the site.

2.6 Release Information

The only documented releases of contamination at the CNTA site are the spills associated with the UC-3 and UC-4 shaker pad areas. The berms at the Central Mud Pit and the uncovered mud pit at UC-4 were breached during the 1973 site restoration project to prevent water accumulation in the pits and to facilitate drying of the drilling mud (see Appendix B). Analytical results for samples collected in 1995 from a runoff ditch draining the Central Mud Pit suggest that drilling mud has not migrated from that pit; however, it currently is unknown whether any of the drilling mud has migrated from the UC-4 pit through the breach.

Table 2-3
Central Mud Pit, Runoff Ditch and UC-4 Mud Pit 1995 Analytical Results
 (Page 1 of 2)

Sample		Reg Std ¹	Central Mud Pit											
Depth (inches)			1A	1B	2A	2B	3A	3B	4A	4B	5A	5B	5C	5D
			0-3	18-21	3-6	20-23	0-3	20-23	0-3	20-23	0-3	20-23	66-72	72-75
TPH ^a (mg/kg) ^b		100	680	470	220	150	840	260	190	290	610	59	25U	25U
TCLP (mg/L) ^c Arsenic		5	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U
Barium		100	2.1	0.80B	2.2	1.3	1.5	0.51B	0.99	0.94	1	1	0.69B	0.54B
Cadmium		1	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U
Chromium		5	23	0.99	25.6	2.2	15.7	1.8	12.3	1.29	14.5	1.5	0.93	0.65
Lead		5	0.26B	0.16U	0.25B	0.16U	0.21B	0.16U	0.16U	0.16U	0.16U	0.16U	0.16U	0.16U
Mercury		0.2	0.00046	0.00018B	0.00022	0.00023	0.00013B	0.0001U	0.0001U	0.00016B	0.00012B	0.0001U	0.0001U	0.0001U
Selenium		1	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U
Silver		5	0.013B	0.0088B	0.088U	0.0088B	0.088U	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U

Refer to footnotes at the end of table.

Table 2-3
Central Mud Pit, Runoff Ditch and UC-4 Mud Pit 1995 Analytical Results
 (Page 2 of 2)

Sample	Req Std ¹	UC-4 Mud Pit						Runoff Ditch			
		6A	6B	7A	7B	8A	8B	9A	10A	11B	12A
Depth (inches)		0-3	20-23	0-3	20-23v	0-3	20-23	0-3	0-3	0-3	0-3
TPH ^a (mg/kg) ^b	100	150	140	96	25U	130	25U	25U	25U	25U	25U
TCLP (mg/L) ^c											
Arsenic	5	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U	0.23U
Barium	100	0.44B	0.49B	0.52B	0.21B	0.57B	0.17B	1.1	1.1	0.68B	0.57B
Cadmium	1	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U	0.012U
Chromium	5	6.6	0.96	6.8	0.53	10.7	10.8	0.1	0.035B	0.017B	0.011U
Lead	5	0.16B	0.16U	0.16B	0.16U	0.16B	0.16U	0.16U	0.16U	0.16U	0.16U
Mercury	0.2	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U	0.0001U
Selenium	1	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U	0.17U
Silver	5	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U	0.0088U	0.011B	0.0088U	0.0088U

^a Total petroleum hydrocarbon(s)

^b Milligram(s) per kilogram

^c Milligram(s) per liter

¹ Regulatory Standard (Nevada State Environmental Commission, 1996; 40 CFR 261)

U = Contaminant not detected at specified level.

B = Reported value is above the instrument detection limit, but below the U.S. EPA Contract Laboratory Program Contract Required Detection Limit

3.0 Study Objectives

As discussed in Section 1.0, this CAIP addresses the surface CAU at CNTA (CAU No. 417). The objectives for the corrective action investigation were established by using the Data Quality Objective (DQO) process developed by the U.S. Environmental Protection Agency (EPA, 1993, 1994). The DQOs are qualitative and quantitative statements that specify the type, amount, and quality of the environmental data required to support corrective action decisions for the impoundment. The DQO process was employed to clearly define the purposes for which environmental data will be collected and used and to design a data collection program that will satisfy these purposes.

3.1 Corrective Action Site Groups

The corrective action investigation at CNTA will address 15 CASs in the surface sites CAU. For the purpose of the CAIP and to simplify the DQO process, the surface CASs have been grouped according to the investigative approach to be used. The site groups developed for the CAIP are identified in the following sections.

3.1.1 Mud Pits, Shaker Pad Areas and Drilling Mud/Grout Piles

The mud pits, shaker pad areas, and drilling mud/grout piles present at the CNTA are all associated with emplacement hole and other well drilling activities. They are expected to have similar contaminants (drilling mud additives) and similar investigative approaches (sampling and laboratory analysis). The CASs included in this group are:

Central Mud Pit Area:

- Central Mud Pit (CMP) (CAS # 58-09-01)
- Mud pit southwest of the CMP (CAS # 58-09-02)
- Two drilling mud/grout piles southwest of the CMP (CAS # 58-44-01)
- Two drilling mud/grout piles west of the CMP (CAS # 58-44-02)

UC-1 Area:

- Mud pit/borrow area near UC-1 (HTH-1 Well) (CAS # 58-09-04)
- Three mud pits near UC-1 (CAS # 58-09-05)

UC-3 Area:

- Five mud pits at UC-3 (CAS # 58-09-06)
- Shaker pad area northeast of UC-3 (CAS # 58-10-01)
- Drilling mud/grout spill area southeast of UC-3 (CAS # 58-44-03)
- Drilling mud/grout spill area southwest of UC-3 (CAS # 58-44-04)

UC-4 Area:

- Five mud pits at UC-4 (CAS # 58-09-03)
- Shaker pad area north of UC-4 (CAS # 58-10-02)

3.1.2 Miscellaneous Surface Sites

Three additional surface CASs need to be located and/or investigated to determine their nature. Based on historical information (AEC, 1973; AEC, 1974), contamination is not expected to be associated with these CASs. The three CASs included in this group are:

- Scrap and trash dump west of UC-3 (CAS # 58-19-01)
- Two protruding pipes north of UC-3 (CAS # 58-99-01)
- Burn area adjacent to the decon facility pit (CAS # 58-35-01)

3.2 Site Conceptual Model

Due to the number of CASs and diversity of site types included in the two surface sites CAS groups, individual site conceptual models have not been developed for each CAS. However, assumptions have been made for the various surface site CASs to formulate the basis for exposure pathways and contaminant migration and to assist in the development of objectives for the corrective action investigation.

The assumptions made for the mud pits are:

- Total petroleum hydrocarbon and chromium are the only hazardous constituents in the mud pits.
- All mud pits except for the Central Mud Pit and one mud pit at UC-4 are covered with soil. All of the mud pits are bermed; however, the berms of the Central Mud Pit and the one uncovered mud pit at UC-4 were breached during the 1973 site restoration operation to prevent water accumulation and facilitate drying of the mud.

- With the exception of the Central Mud Pit and the uncovered mud pit at UC-4, the quantity of drilling mud in the mud pits is unknown. The planning directive for the 1973/1974 site restoration project indicates that little or no mud was present in the mud pits before restoration activities were initiated (AEC, 1973). However, if mud is present in any of the covered mud pits, it should be readily apparent in samples collected from the pits because of its clayey texture and dark gray to black color and should be readily detectable by electrical geophysical measurements.
- Drilling mud in the central mud pit is approximately 5 ft thick in the central portion of the pit.
- The drilling mud in the uncovered mud pit at UC-4 is approximately four feet thick. Because of the similarities between this pit and the other pits at UC-4 and UC-3, a maximum of four feet of mud is expected in the covered pits.
- During the site demobilization and restoration activities conducted and documented by the AEC in 1973 and 1974, some or all of the mud pits at UC-3 were used for disposal of nonflammable scrap materials and nonsalvageable items prior to being covered with soil (Appendix B).
- Based on historical documentation and process knowledge, the drilling mud present in all of the mud pits at each location should be similar in composition (i.e., the analytical results for one mud pit at a location should be representative of all mud pits at that location). The drilling mud specifications for UC-3 and UC-4 are included in Appendix B.
- Because drilling mud was discharged to the mud pits in a mostly aqueous form, diesel fuel, mixed with the mud during drilling operations, is expected to have "floated" to the top of the mud after drilling operations stopped. Because of this, the diesel fuel is expected to be concentrated near the top of the mud.
- Groundwater is approximately 168 m (550 ft) below the ground surface.
- There has been little or no migration of contaminants from the mud pits into underlying soils due primarily to the contaminant adsorption capacity of bentonite and the lack of precipitation to act as a driver for contaminant migration. In addition, the bermed mud pits at UC-3 and UC-4 were lined with bentonite before mud was introduced, which would further inhibit migration into the underlying soils.
- The primary potential exposure route is by ingestion and/or inhalation of contaminated soil resulting from intrusion into the mud pits.

The assumptions made for the shaker pad areas are:

- The drilling mud spilled from the UC-3 and UC-4 shaker pads was covered with clean soil during the 1973/1974 site restoration project (AEC, 1974). It is assumed that the cover soil is no more than three feet thick.
- It is unknown how much mud was spilled from the shaker pads, how thick the spilled mud may be, or how thick the soil cover is. However, if a layer (or layers) of mud is present in the soils, it should be readily apparent in samples collected from the areas of the spills because of its color (dark gray to black) and should be readily detectable by geophysical measurements.
- There has been little or no migration of contaminants from the mud spills into underlying soils due primarily to the contaminant adsorption capacity of bentonite and the lack of precipitation to act as a driver for contaminant migration.

The assumptions made for the drilling mud/grout piles are:

- It is unknown whether the drilling mud/grout piles are composed of drilling mud, cement grout, or both. However, the light gray color of the material suggests that it is likely to be cement grout, since drilling mud in both the Central Mud Pit and the one uncovered mud pit at UC-4 is dark gray to black.

The assumptions made for the miscellaneous CAS group are:

- The scrap and trash dump was a trench that was used for disposal of nonflammable debris and nonsalvageable items (all nonhazardous) during the 1973/1974 site restoration project (AEC, 1973, 1974) (Appendix B). The trench was covered with clean soil during the restoration project, and its exact location currently is unknown. All material disposed of in the dump is expected to be confined to the trench.
- The two protruding pipes north of UC-3 may be associated with some type of an underground structure, such as an underground storage tank (UST), that is currently filled with sand or soil.
- The decontamination facility pit was lined with an asphalt-plastic membrane (Figure 2-3). It is expected that the material observed in the burned area is actually weathered liner material from the decontamination pit, as the location of the material corresponds with the location of the decontamination facility pit (see Section 2.2.1).

3.3 Contaminants of Potential Concern

3.3.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

The contaminants of potential concern (COPCs) for the mud pits, shaker pad areas, and drilling mud/grout piles are constituents of drilling mud additives that were used at the site. Based on historical records (Appendix B) and field data, the COPCs are:

- Total petroleum hydrocarbons such as diesel
- Chromium (from chrome lignosulfonate and/or chrome lignite)

Chrome lignosulfonate and chrome lignite were included in the drilling mud specifications for UC-3 and UC-4 (Appendix B). Samples collected from the Central Mud Pit and the uncovered mud pit at the vicinity of UC-4 by DOE/NV and IT personnel in 1995 contained TPH as diesel and waste oil and also contained levels of chromium that exceeded the RCRA (40 CFR 261.35) toxicity characteristic limit (5 mg/L) in Toxicity Characteristic Leaching Procedure extracts from the samples (Table 2-3). There are no historical records of RCRA hazardous wastes on site. Previous sampling events have shown no evidence for the presence of any other COPCs at the site.

In addition to the above COPCs, man-made radionuclides are COPCs for UC-1 mud pit 1D (Figure 2-4) because this mud pit may have been used to store waste drilling mud generated during the drillback operation into the UC-1 shot cavity.

3.3.2 Miscellaneous Surface Sites

Based on the assumptions described in Section 3.2, no COPCs have been identified for the three CASs in this group.

3.4 DQO Process

The DQO process is a systematic planning tool for establishing criteria for data type, quantity, and quality and for developing data collection programs that satisfy the needs of the project. It is an iterative, seven-step process, and these seven steps are:

- State the problem.
- Identify the decision.
- Identify the inputs to the decision.
- Define the study boundaries.

- Develop decision rules.
- Specify limits on the decision errors.
- Optimize the design for obtaining data.

These seven steps have been applied to the CNTA CAS groups, and they support a course of action for investigating the CNTA surface CAU.

The problem areas as discussed in the following DQO steps are based on grouping by CAS (i.e., mud pit, shaker pad, or drilling mud/grout piles). The on-site decision-making required by the ESC process suggests the following field analytical schedule. The sampling crews will be mobilized to each of the UC sites sequentially, not only to minimize travel time, but to also provide for all decision-makers to be involved in each type of CAS at one site. The sequential order for sampling will begin at the Central Mud Pit, followed by UC-4, UC-3, and UC-1 CASs. This will allow scrutiny of all sampling and analysis procedures and strategies at the first site, and modifications can be incorporated before moving to the second UC site. As a result, the three UC sites and the central mud pit can be considered as four nearly separate investigations during one field mobilization.

3.4.1 Statement of the Problem

3.4.1.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

The primary problem with the CASs included in this group is that the mud pits, shaker pad areas, and drilling mud/grout piles may contain contaminants that pose a threat to human health and the environment. The presence of these contaminants in most of the areas has not been determined, and, where present, their extent is unknown. Sections 2.3, 2.5, and 3.4.1 of this CAIP provide more detailed information regarding potential contamination at these CASs.

3.4.1.2 Miscellaneous Surface Sites

The primary problems with the three CASs included in this group are that the location and areal dimensions of the scrap and trash dump are currently unknown; the purpose of the two protruding pipes north of UC-3 is unknown; and the composition of the material in the burned area is unknown.

3.4.2 Identification of the Decision

3.4.2.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

Implementation of the mud pits, shaker pad areas, and drilling mud/grout piles investigation portion of this CAIP is intended to support the following decisions:

- Decide whether the soils and drilling mud present in the mud pits, shaker pad areas, and drilling mud/grout piles are contaminated above preliminary action levels. The contaminants of potential concern for these areas are discussed in Section 3.4.1, and preliminary action levels are discussed in Section 3.4.3.3.
- Decide whether contaminated drilling mud has migrated from the breaches in the Central Mud Pit and uncovered UC-4 mud pit berms.

3.4.2.2 Miscellaneous Surface Sites

Implementation of the miscellaneous surface sites portion of this CAIP is intended to support the following decisions:

- Determine the location and areal extent of the scrap and trash dump west of UC-3.
- Decide whether the two protruding pipes north of UC-3 are associated with an underground structure and, if so, determine what that structure is.
- Decide whether the material at the suspected burn area adjacent to the decontamination facility pit is weathered liner from the pit.

3.4.3 Identification of Inputs to the Decision

3.4.3.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

The potential contamination of the soils and drilling mud present in the mud pits, shaker pad areas, and drilling mud/grout piles will be evaluated by collecting and analyzing samples from these areas. Potential contaminant migration from the Central Mud Pit and the uncovered mud pit at UC-4 will be evaluated by collecting and analyzing samples from outside of those mud pits in the vicinity of the breaches in the mud pit berms. Appendix C and Section 4.0 of this CAIP provide a detailed description of the sampling and analysis program for the mud pits, shaker pad areas, and drilling mud/grout piles.

Although historical information is available for the site, it is not sufficient to confirm that any wastes disposed of in the mud pits or shaker pad areas would be considered RCRA listed wastes. Because of this, it is assumed that if the mud pit, shaker pad area, and drilling mud/grout piles soils and/or drilling mud are removed as a part of site remediation, they would be characteristic wastes. The sampling and analysis program for the mud pits, shaker pad areas, and drilling mud/grout piles described in Appendix C includes collection samples of soils or drilling mud for TCLP volatile and semivolatile organic compounds and TCLP metals analyses from areas that exceed TPH and/or hexavalent chromium preliminary action levels to allow evaluation of remedial alternatives and to support waste management decisions.

3.4.3.2 Miscellaneous Surface Sites

The scrap and trash dump west of UC-3 and the two protruding pipes north of UC-3 will be evaluated by using surface geophysical surveys as described in Section 4.1. If the two protruding pipes are associated with an underground storage tank, samples will be collected from inside of the tank to determine if it contained petroleum products and from the soils adjacent to the tank to determine if it had leaked. The suspected burn area adjacent to the decontamination facility pit will be evaluated by visual inspection to determine if the material that appears to be burned is degraded liner from the pit.

3.4.3.3 Preliminary Action Levels

As discussed in Section 3.4.1, the primary COPCs for the CNTA mud pits, shaker pad areas, and drilling mud/grout piles are TPH and chromium. In addition, man-made radionuclides are COPCs for one of the mud pits located at UC-1 (pit 1D on Figure 2-5), even though they were not detected in previous investigations. In order to develop decision rules using the DQO process (Section 3.4.5, below), it is necessary to first develop preliminary action levels. For this purpose of the CAIP, the preliminary action levels are based on the corrective action regulation adopted by the Nevada State Environmental Commission on September 10, 1996 (Nevada State Environmental Commission, 1996). These preliminary action levels for the targeted analytes are:

- **TPH** - 100 mg/kg, which is the NDEP regulatory action level for TPH set forth in the corrective action regulation (Nevada State Environmental Commission, 1996).
- **Chromium (total)** - 390 mg/kg, which is the generic soil screening level (SSL) for hexavalent chromium published in the EPA guidance document entitled *Soil Screening Guidance: Technical Background Document* (EPA, 1996a). This SSL also applies to total chromium concentrations when the portion of the total concentration that is

hexavalent chromium is unknown. Although hexavalent chromium is not expected to be present in the mud pits or shaker pad areas, its SSL is more conservative than the SSL for trivalent chromium (78,000 mg/kg), so it is being used to establish the chromium measurement objective for the project. As described in Appendix B, if the total chromium concentration in a sample exceeds the preliminary action level, then the percentage that is hexavalent chromium will be determined.

The chromium SSL developed by EPA was selected as the preliminary action level in accordance with the Nevada corrective action regulation for sites where ingestion, dermal contact, and/or inhalation are the primary exposure pathways (Nevada State Environmental Commission, 1996).

- Man-made radionuclides - analytical laboratory reporting limits

It should be noted that the preliminary action levels identified for this CAIP are not necessarily the cleanup goals for the CASs, but are primarily intended to provide the basis for decisions and decision rules and to ensure that the analytical methods selected for the project are capable of measuring the contaminants of potential concern at or below levels of concern.

3.4.3.4 Measurement Objectives

The analytical measurement objectives for the mud pit, shaker pad area, and drilling mud/grout pile samples have been established at 50 percent of the preliminary action level values (except for radionuclides) to ensure that the analytical methods selected for the project are capable of meeting quantitation limit needs for the project. Table 3-1 provides a list of the analytical methods to be used, the measurement objectives for the targeted analytes, and the field and laboratory analytical reporting limits for the targeted analytes that typically are achieved for similar matrices. As indicated in the table, the analytical methods specified for nonradiological analyses for the project are capable of measuring the targeted analytes at levels significantly below the measurement objectives.

Table 3-1 also lists the analytical accuracy and precision goals established for the project. These goals are separate from the analytical QC acceptance criteria identified in the specified analytical methods and are intended to serve as additional criteria to assess how representative the field sample results are to the media sampled. The accuracy and precision measurement goals will be evaluated using the analytical results for field duplicates and matrix spike/spike duplicates as described in the Industrial Sites QAPP (DOE, 1996). All field and QC sample analytical results will be assessed in accordance with the Industrial Sites QAPP (DOE, 1996) under the guidance

Table 3-1
CNTA Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles
Investigation Measurement Objectives

Analyte	Method	Measurement Goal	Analytical Reporting Limit	Precision (RPD)	Accuracy (%R)
TPH (diesel)	3545/8015 ^a Modified	50 mg/kg	25 mg/kg	±40	61 to 144
Total Chromium	XRF	195 mg/kg	60 mg/kg	NS	NS
Total Chromium	3051/7190 ^b	195 mg/kg	10 mg/kg	±35	75 to 125
Hexavalent Chromium	3060A/7196A ^b	195 mg/kg	130 mg/kg	±35	75 to 125
Gross Alpha	SM 7110 ^c	1 pCi/g	1 pCi/g	±25	75 to 125
Gross Beta	SM 7110 ^c	3 pCi/g	3 pCi/g	±25	75 to 125
Gamma-spec	HASL 300, 4.5.2.3 ^d	1 pCi/g	1 pCi/g	±25	75 to 125
Tritium	EERF H-01 ^e	1 pCi/g	1 pCi/g	±25	75 to 125

^aEPA SW-846, *Test Methods for Evaluating Solid Waste*, 3^d Edition, modified according to the California State Water Resources Control Board, *Leaking Underground Fuel Tank Field Manual, Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*, Appendix B (EPA, 1996b)

^bEPA, SW-846, *Test Methods for Evaluating Solid Waste*, 3^d Edition (EPA, 1996b)

^cAmerican Public Health Association, *Standard Methods for the Examination of Water and Wastewater* (APHA, 1992)

^dU.S. Department of Energy *Environmental Measurements Laboratory Procedure Manual*, HASL-300 (DOE, 1992a)

^eEPA Eastern Environmental Radiation Facility (EPA, 1984)

pCi/g = PicoCurie(s) per gram

mg/kg = Milligram(s) per kilogram

RPD = Relative percent difference

%R = Percent recovery

NS = Not specified (see Appendix C, Section C.1.1.1)

of the Quality Assurance Coordinator (who for this project will be Kevin Cabbie of DOE/NV with Cheryl Prince of IT as the alternate).

3.4.4 Definition of the Study Area

3.4.4.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

Each mud pit, shaker pad area, and drilling mud/grout pile will be an individual study area. The physical boundaries of the mud pits study areas are:

- Within the bermed area of each mud pit
- Outside of and downslope from breached berms, as determined by historical aerial photography (RSL, 1968), visual observations of breached berms, and surface geophysical data indicating enhanced soil electrical conductivity
- Six meters (20 ft) below the bottom of each mud pit or 0.6 m (2 ft) below the deepest sample that exceeds action levels, whichever is shallower

The physical boundaries of the shaker pad study areas are:

- The horizontal extent of the apparent drilling mud spills as determined by historical aerial photography (RSL, 1968), visual observations, and surface geophysical data indicating enhanced soil electrical conductivity
- A depth of 6 m (20 ft) below the ground surface or 0.6 m (2 ft) below the deepest sample that exceeds action levels, whichever is shallower. The physical boundaries of the drilling mud/grout piles study areas are the horizontal and vertical extent of each pile.

These boundaries are based on the preliminary site conceptual models discussed in Section 3.2 of the CAIP. The physical boundaries of the mud pits, shaker pad areas, and drilling mud/grout piles study areas may change depending on the results of the analytical data generated during sampling. There are no temporal constraints or boundaries for collection and use of data for the mud pits, shaker pad areas, and drilling mud/grout piles study areas.

3.4.4.2 Miscellaneous Surface Sites

Each of the three CASs in this group will be an individual study area. The physical boundaries of the scrap and trash dump study area are:

- The horizontal extent of apparently disturbed ground in the area where the dump is thought to be located
- The depth to which the surface geophysical instruments used for the investigation are effective

The physical boundaries of the two protruding pipes study area are:

- A horizontal area within a five-meter radius of the pipes
- The depth to which the surface geophysical instruments used for the investigation are effective

The physical boundaries of the suspected burn area study area are the horizontal extent of the apparently burned material. No vertical boundaries have been established for the suspected burn area because the investigation of that area will consist of only visual inspection of the material that appears to be burned to confirm that it is part of the decontamination facility pit liner.

These boundaries are based on the preliminary site conceptual models discussed in Section 3.2 of the CAIP. The physical boundaries of miscellaneous surface sites study areas may change depending on the results of the investigations. There are no temporal constraints or boundaries for collection and use of data for the miscellaneous surface sites study areas.

3.4.5 Development of Decision Rules

3.4.5.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

The analytical results for the samples collected from the mud pits, shaker pad areas, and drilling mud/grout piles will be used to determine if the mud pits and/or shaker pad areas require remediation. Since the character of the mud pits, shaker pads, and mud/grout piles differ fundamentally, the decision rules for each will vary.

3.4.5.1.1 Mud Pits

The mud pits contain two subsites (within the berms and outside of breached berms) which involve different decision rules. Evidence of a berm breach would include, but would not be limited to, visual observations of the presence of bentonite or petroleum staining and geophysical data suggesting high clay content in soil outside of the berm.

For the mud pits subsites within berms, if the upper 90 percent confidence levels of the mean concentrations of all contaminants of potential concern are below preliminary action levels (see Section 3.5.3.4 for a discussion of preliminary action levels), then no further action will be required. If the upper 90 percent confidence level of the mean concentration of any contaminant

of potential concern equals or exceeds its preliminary action level, then the mudpit(s) will be addressed in the Corrective Action Decision Document (CADD). Appendix C provides a detailed discussion of the statistical sampling program designed to support application of this decision rule, and Figure 3-1 presents a flow chart for mud pit sampling based on the statistical design.

For the mud pits subsites outside of breached berms, if the concentration of any contaminant of potential concern equals or exceeds its preliminary action level, additional samples will be collected to determine the horizontal and vertical extent of the contamination outside of the berm. Once these boundaries have been determined, the statistical evaluation of analytical data described for the mud pits within the berms will be applied to the contaminated area outside of the berm.

3.4.5.1.2 Shaker Pad Areas and Mud/Grout Piles

The shaker pad areas are similar to the mud pits subsites outside of breached berms since, in both cases, the areas are not controlled by engineered structures. Because of this, the decision rules for the shaker pad areas are essentially the same as the decision rules for the mud pits subsites outside of breached berms described in the previous section.

3.4.5.1.3 Drilling Mud/Grout Piles

The primary decision to be made for the drilling mud/grout piles is whether or not the material in the piles can be removed and disposed of as inert construction debris or whether it requires handling as some other type of waste. If the concentrations of all contaminants of potential concern in a drilling mud/grout pile are below preliminary action levels, then the material will be handled as construction debris. If the concentration of any contaminant of potential concern equals or exceeds its preliminary action level in drilling mud/groutpile, then the drilling mud/grout pile will be addressed in the CADD.

3.4.5.2 Miscellaneous Surface Sites

The primary goals of the scrap and trash dump and the suspected burn area investigation are to find the dump and to confirm that the material that appears to be burned is part of the liner from

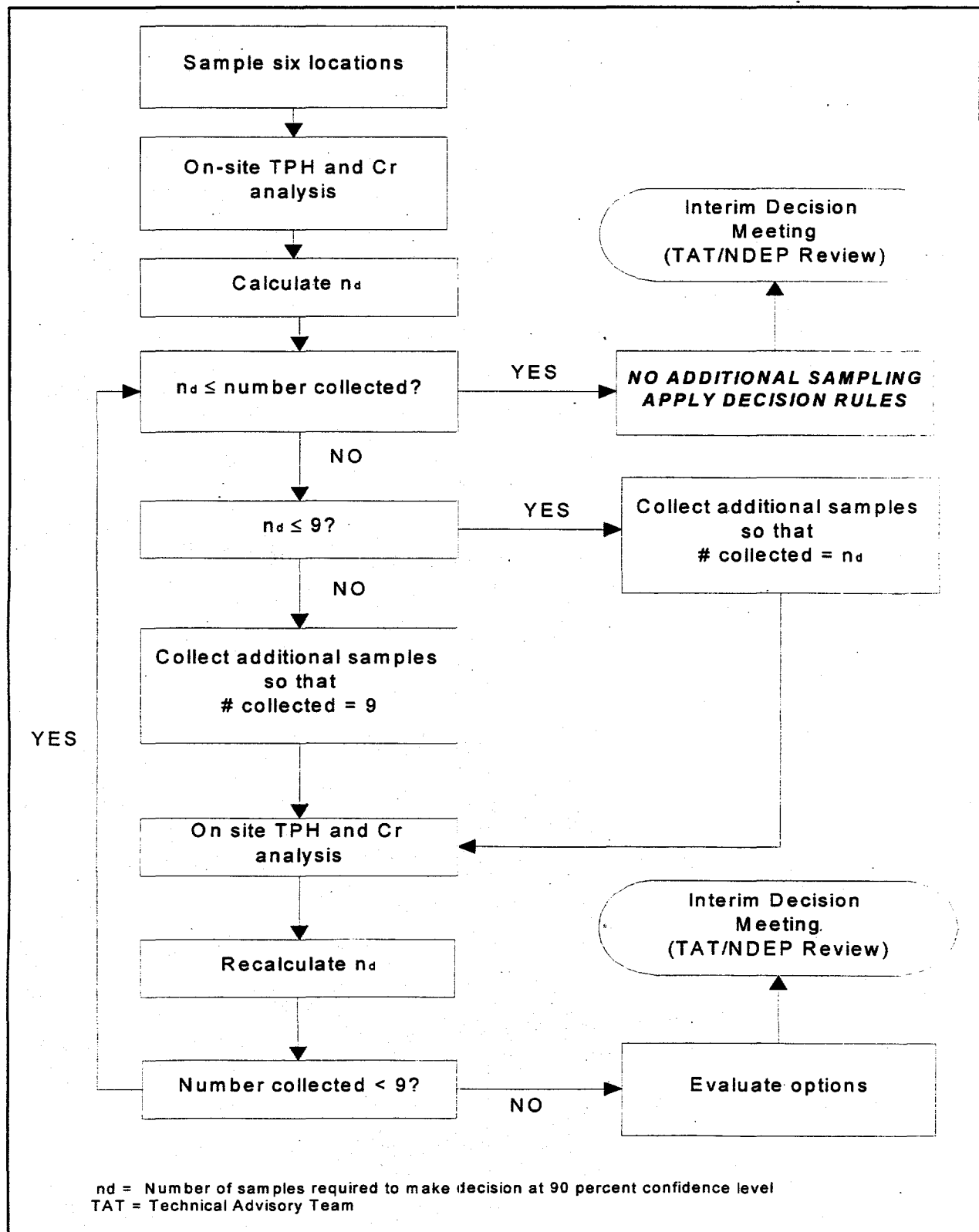


Figure 3-1
Sampling Flowchart, Central Nevada Test Area Mud Pits

the decontamination facility pit. Upon completion of the investigation, the scrap and trash dump (if found) and the suspected burn area adjacent to the decontamination facility pit will be added to the list of ER housekeeping sites and will be addressed along with the other housekeeping sites.

If the two protruding pipes north of UC-3 are found to be associated with a UST, samples will be collected from inside of the tank to determine if the tank contained petroleum products and from the soils adjacent to the tank to determine if the tank has leaked. If an underground storage tank is found at the location, it will be addressed in the CADD.

3.4.5.3 Additional Decision Rules

It is possible that unexpected conditions will be encountered that will necessitate field decisions to change the investigation approach for CNTA or will necessitate a stop in work. For example, if radiological screening of samples from UC-1 mud pit 1D are significantly above background, those samples will be sent to an off-site fixed laboratory for analysis instead of the on-site mobile laboratory. Most operational, stop-work issues will be addressed in the site-specific HASP and QAPP. Section C.2 of Appendix C provides a detailed description of the decision rules established for the on-site analytical system. If conditions at the site are substantially different than expected, so that the data collected during the investigation as currently proposed would clearly not be useful for supporting the decision-making process, the work will be terminated; NDEP will be notified; and the investigation will be rescoped.

3.4.6 Interim Decision Meetings

The decision-making process will be facilitated by conducting a review of the investigation derived data/information from specific CASs or groups of CASs. These meetings will provide information relating to characterization of specific CASs as well as documentation that sufficient information has been obtained to characterize sites as specified in this CAIP. The CNTA Core Team members will inspect and review all data resulting from the investigation of a CAS. These interim decision meetings provide a forum for discussion and consensus as to the adequacy of the characterization of individual CASs within the constraints of the Decision Rules as described in Section 3.4.5 of this document. Attendees at these meetings will include representatives of the Technical Advisory Team and representatives from NDEP. Interim decision meetings will be scheduled in advance of concluding investigations of CASs within the areas of UC-1, UC-3 and UC-4.

3.4.7 Specification of Limits on Decision Errors

3.4.7.1 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles

Based on existing information, it currently is assumed that the mud pits, shaker pad area soils, and drilling mud/grout piles contain levels of contaminants (TPH and/or chromium) that exceed action levels (the "null hypothesis" for statistical testing). The primary decision errors in implementing the mud pit, shaker pad area, and drilling mud/grout pile investigation portion of the CNTA CAIP are deciding that no further action is required when concentrations of contaminants of potential concern actually exceed preliminary action levels (a false positive error) or deciding that active remedial action is required when concentrations of all contaminants of potential concern are actually below preliminary action levels (a false negative error).

The primary consequence of a false positive error is that contamination would remain in place without controls, and potential threats to human health and the environment would continue.

The primary consequence of a false negative error would be spending funds on active remediation when no remedial action was required.

Control of potential errors depends foremost on the accuracy of the assumptions made for the CASs because these assumptions are used to design the sampling and analysis program. If the assumptions are accurate, the sampling and analysis program generally will provide adequate data for supporting decisions. The decision error rate goal for the surface investigation portion of this project has been set at no more than a 10 percent chance of making a decision error.

The sampling program for the CNTA surface investigation has been designed to provide data to allow statistical determination of whether an appropriate number of samples has been collected to support application of the decision rules at the specified level of confidence (90 percent, which is equivalent to the 10 percent decision error rate goal identified above). This determination will be made using the procedures described in Chapter 6 of the EPA publication *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media* (EPA, 1989). The mean concentration (or activity for radionuclides) and standard deviation of each targeted analyte detected in the soil and drilling mud samples from each mud pit and shaker pad study area will be used to calculate the number of samples necessary to make the determination at the 90 percent confidence level. If the calculated number of samples is less than or equal to the number of samples actually collected, no additional samples would be required to support the

decision with no more than a 10 percent chance of making a decision error. If the calculated number of samples is greater than the number actually collected, then either additional samples can be collected to meet the specified level of confidence, or the decision could be made with the level of confidence calculated for the number of samples collected. Appendix C provides a more detailed discussion of the statistical sampling design.

3.4.8 Optimization of the Design for Obtaining Data

The sampling and analysis approaches for the CNTA surface investigation described in Section 4.0 and Appendix C of this CAIP were developed to optimize the design for obtaining data to meet the data quality objectives for the site. If these approaches result in insufficient data to support the decisions to be made, the DQO process will be evaluated.

3.4.9 Technical Approach

The technical approach for the surface investigation sampling and analysis program is described in detail in Appendix C.

4.0 Corrective Action Investigation Sampling and Analysis Tasks

This section of the CAIP describes the methodology for the investigation of CNTA surface CASSs. The DQO process has been implemented in order to design a data collection program that will support the site's data needs and to supply sufficient site characterization information to make a decision concerning remedial action and closure. The principals of ESC will guide the overall investigation to the degree that it is applicable. All sampling activities will be conducted in compliance with the *Industrial Sites QAPP* (DOE, 1996) and all applicable approved procedures. Requirements for field and laboratory environmental sampling QA/QC are contained in the *Industrial Sites QAPP* (DOE, 1996).

4.1 Geophysical Surveys

Surface geophysical surveys will be conducted over the entire disturbed areas at UC-1, UC-3, and UC-4. The targets of these surveys are the covered mud pits, shaker pad areas, scrap and trash dump, and protruding pipes. Surface geophysical surveys will be used to aid in locating backfilled mud pits, determine mud pit boundaries, locate spilled mud in the vicinity of shaker pads and breached mud pit berms, characterize pit contents (e.g., buried metal), select locations to begin chemical sampling, and provide a limited amount of near-surface stratigraphic information. In addition, intrusive soil electrical conductivity measurements will be taken using a Geoprobe® conductivity logging system. This instrument will be used to provide depth-to-mud and mud thickness data not determinable from the surface geophysical systems.

A 6 m x 6 m (20 ft x 20 ft) grid will be installed over each UC area. Steel stakes will be placed at the four corners of each grid, and their locations will be determined with respect to the coordinate system currently used at the CNTA. The grid will be used to guide the acquisition of data. Four electromagnetic induction (EM) systems and ground-penetrating radar (GPR) will be used. In addition, a magnetometer will be used to assist in assessing the presence of a buried tank near the protruding pipes at UC-3. Continuous EM measurements will be taken and recorded digitally over the grid. GPR profiles will be acquired over selected areas of interest.

4.2 Mud Pits, Shaker Pad Areas, and Drilling Mud/Grout Piles Investigation

4.2.1 Core Sampling of the Mud Pits

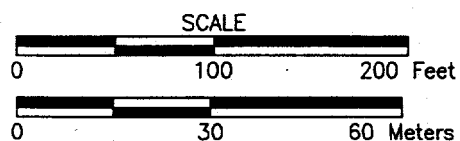
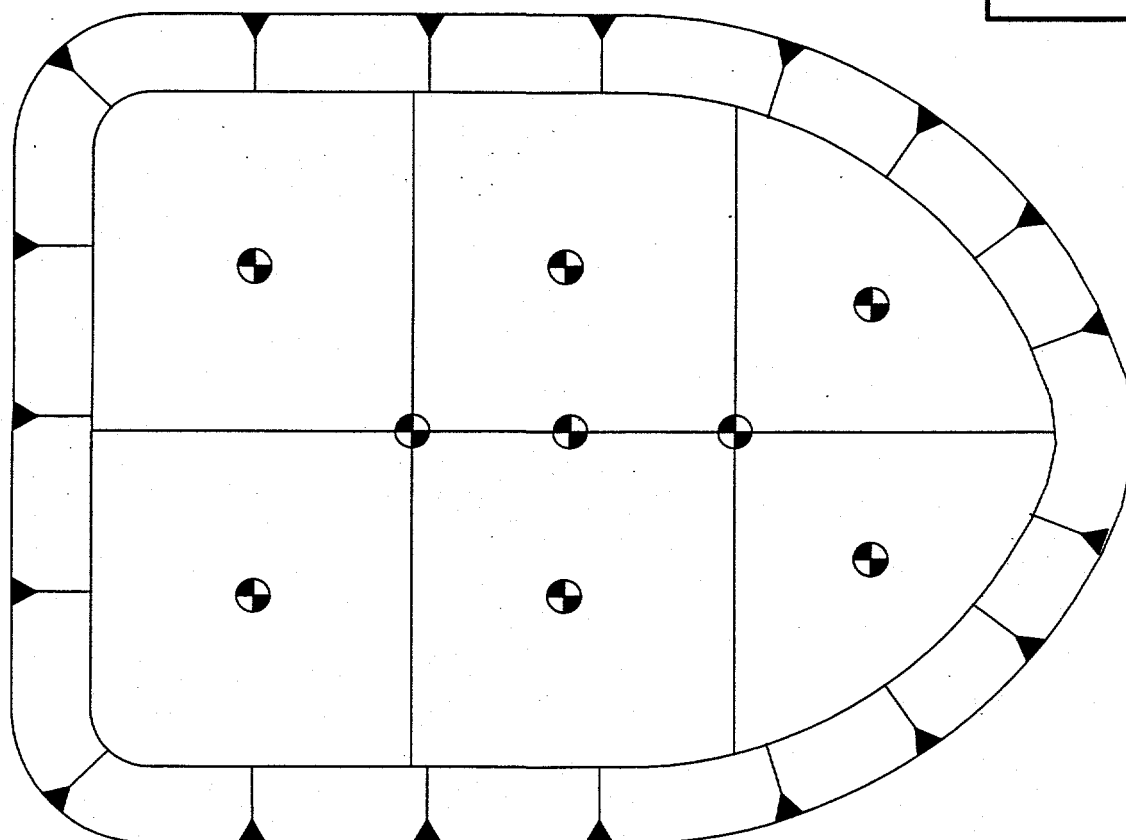
Each mud pit will be divided into six equal-area sections by bisecting the mud pit along the long dimension and trisecting the mud pit along the short dimension (Figures 4-1 through 4-5). The initial six sampling locations for each pit will be in the center of each section. The remaining three sampling locations (if needed) will be at the grid nodes (two locations) and the center of the mud pit (one location).

Samples will be collected from the mud pits by means of a truck- or skid-mounted Geoprobe® system capable of collecting continuous core samples. Samples will be collected in accordance with SQP ITLV-0601, "Shallow Subsurface Soil Sampling with Hand Auger and Coring Device." At the first location in each mud pit, if depth-of-mud information has not been previously acquired by geophysical measurements, the core barrel will be advanced from the ground surface to a depth of ten feet to allow identification of the thickness of mud in the pit. At subsequent locations in the mud pit, the core barrel will be advanced to at least two feet into the native soils below the bottom of the drilling mud or until refusal, whichever is shallower.

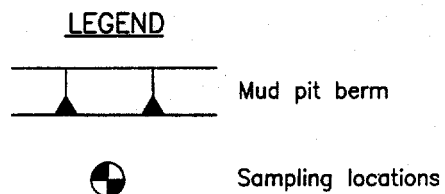
If several borings at each location are necessary to collect an adequate volume of soil for the required analyses, additional borings will be advanced in a circular pattern around the first boring location at a distance interval of not greater than one foot.

Materials collected from the core barrel will be described by a field geologist. A description of the retrieved materials will include:

- Color
- Odor (specifically, petroleum odor)
- Visual soil classification (grain size)
- Relative moisture (dry to wet)
- Relative density (loose to hard)
- Unified Soil Classification System symbol
- Type of materials - fill or natural
- Depth interval of sample collected
- Contact between drilling mud and native materials
- Nature of material - stratified or massive

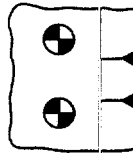


Note: CAS = Corrective action site



Compiled and modified from: Fenix & Scisson, 1968,
 U.S. Atomic Energy Commission, 1973, and
 1968 and 1993 CNTA Aerial Photographs from
 DOE/NV Remote Sensing Laboratory

Figure 4-1
Sampling Locations, Central Mud Pit

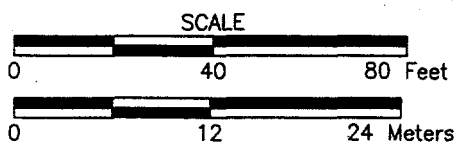
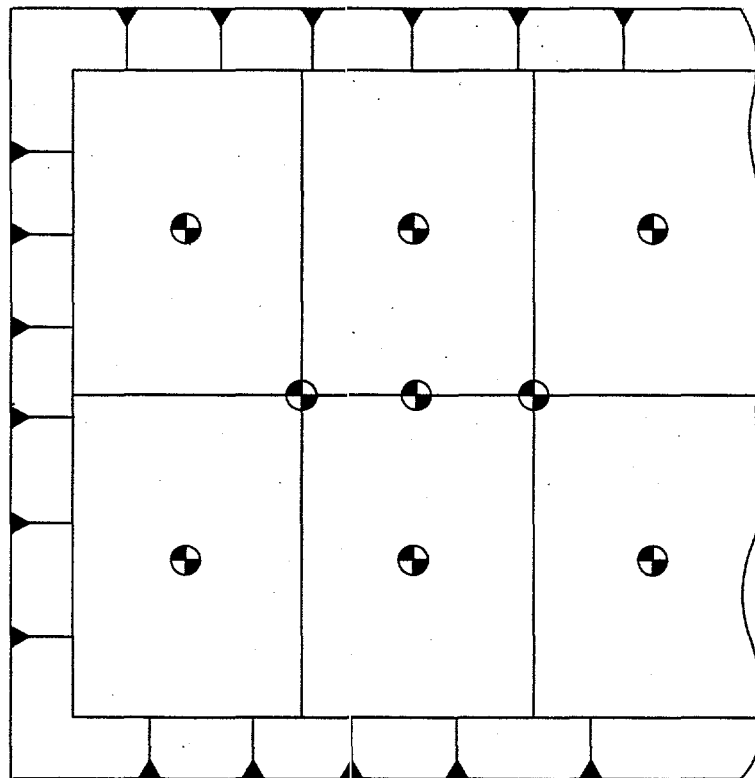


Pit 1A
CAS 58-09-02

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Pit 1B
CAS 58-09-04



LEGEND



Mud pit berm



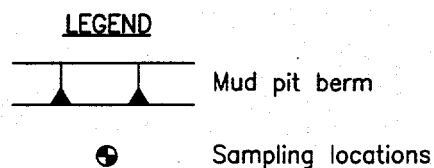
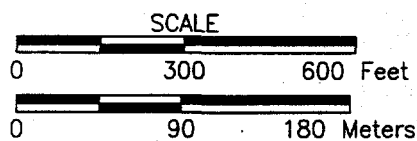
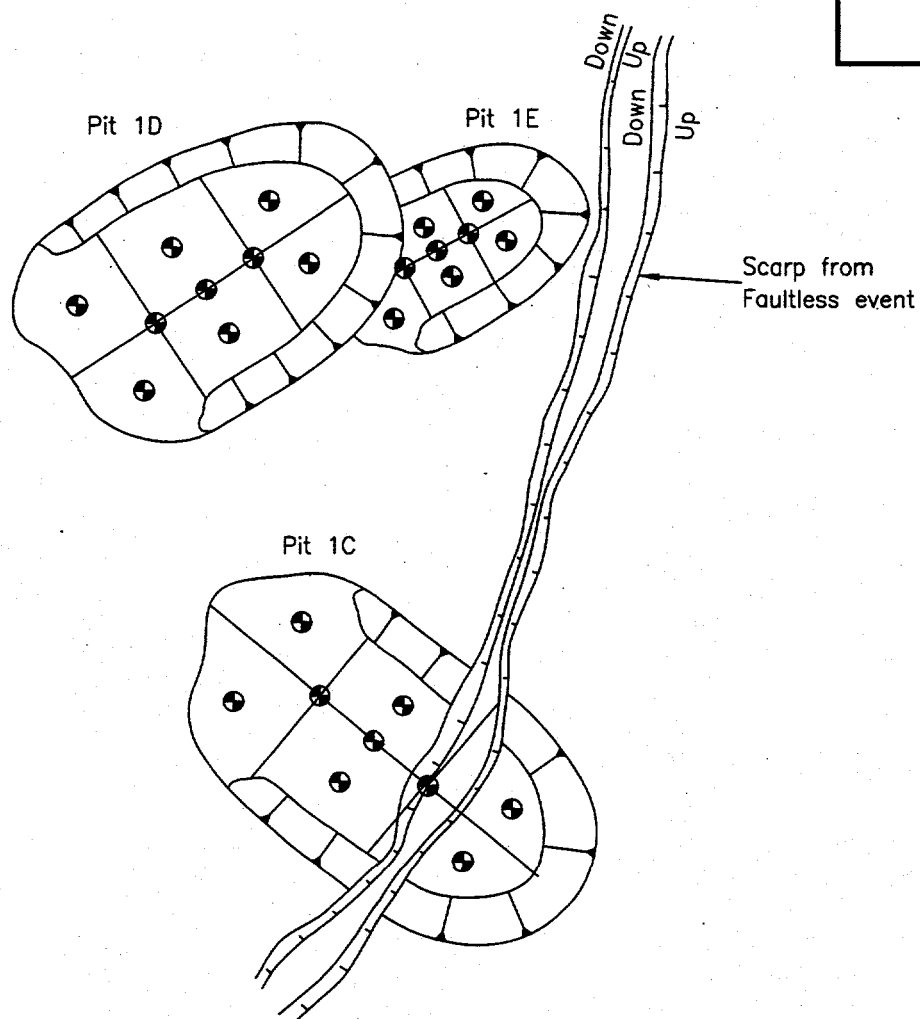
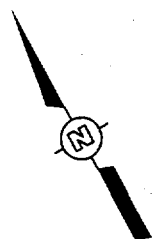
Sampling locations

Note: CAS = Corrective action site

Compiled and modified from: Fenix & Scisson, 1968,
U.S. Atomic Energy Commission, 1973, and 1968 and 1993 CNTA
aerial photographs from DOE/NV Remote Sensing Laboratory

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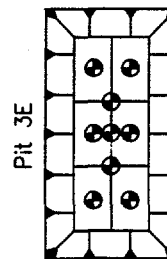
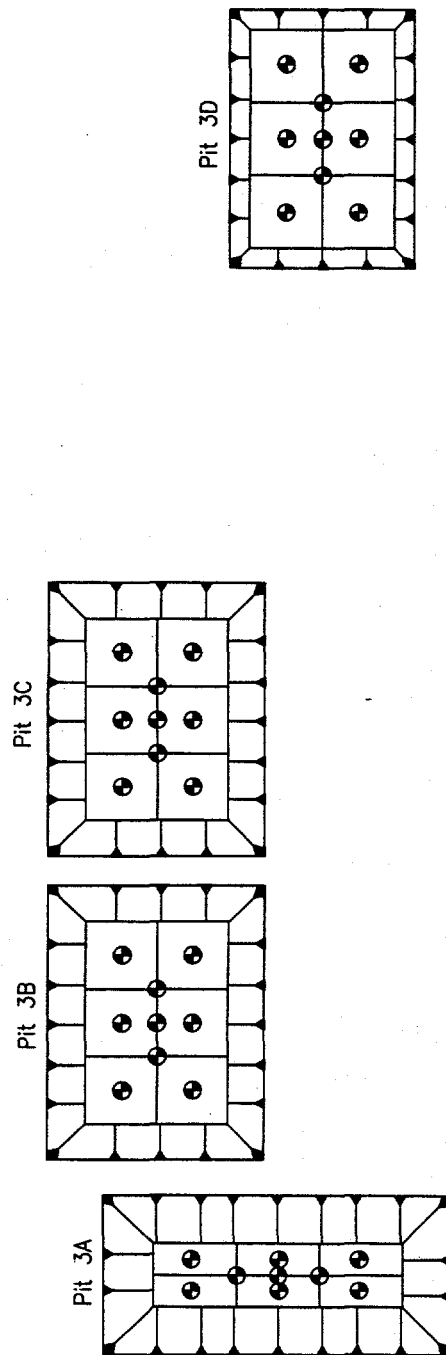
Figure 4-2
Sampling Locations, Additional Mud Pits at UC-1



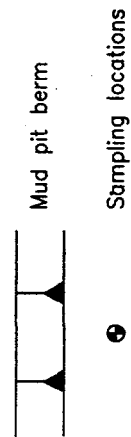
Note: CAS = Corrective action site

Modified from: 1993 aerial photograph from
 DOE/NV Remote Sensing Laboratory

Figure 4-3
Sampling Locations, UC-1 Mud Pits



LEGEND

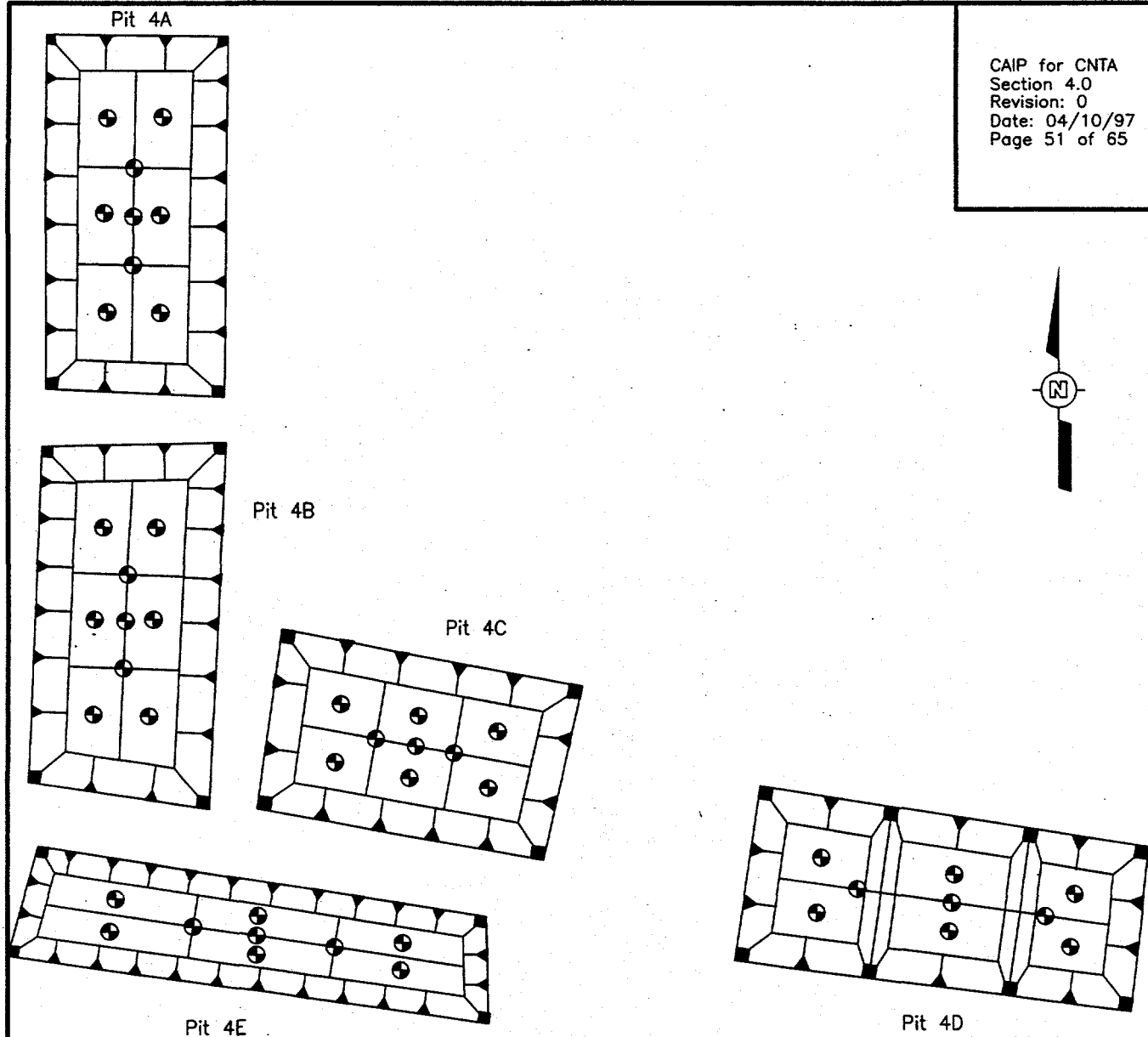


Notes

1. CAS = Corrective action site
2. All pits at UC-3 were observed to be backfilled during February 1996 site reconnaissance visit.

Compiled and modified from: Fenix & Scisson, 1968,
U.S. Atomic Energy Commission, 1973, and 1968 and 1993
CNTA aerial photographs from DOE/NV Remote Sensing Laboratory.

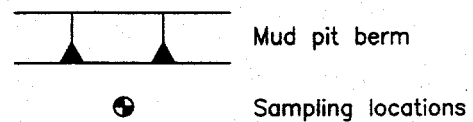
Figure 4-4
Sampling Locations, UC-3 Mud Pits



Pit 4E

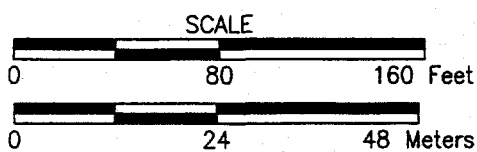
Pit 4D

LEGEND



Notes

1. CAS = Corrective action site
2. All pits except pit 4C were observed to be backfilled during February 1996 site reconnaissance visit.



Compiled and modified from: Fenix & Scisson, 1968, U.S. Atomic Energy Commission, 1973, and 1968 and 1993 CNTA aerial photographs from DOE/NV Remote Sensing Laboratory

Figure 4-5
Sampling Locations, UC-4 Mud Pits

The cores extracted at each sampling location will be split into samples representing two-foot depth increments from the ground surface to two feet below the bottom of the drilling mud. If multiple cores are needed to obtain the required sample volumes, the samples from the desired depth increment from each boring will be composited into one uniform sample representing that depth increment.

After collection of each sample, the core barrel will be decontaminated in accordance with SQP ITLV-0405, "Sampling Equipment Decontamination" (IT, 1995); and at the completion of sampling at each location, the cutting shoe, barrel, stop pin, and drive rods also will be decontaminated using the same process. Decontamination fluids will be containerized for later disposal in accordance with all applicable regulations. Upon completion of sampling, the Geoprobe® soundings will be backfilled with bentonite pellets.

The samples collected from pit 1D at UC-1 (Figure 4-3) will be screened with portable alpha and beta/gamma detectors. If the screening results are significantly above background, the samples from pit 1D will be sent to an off-site fixed laboratory for all analyses.

All samples collected will be analyzed for TPH and hexavalent chromium. Analyses for both TPH and chromium will be conducted in an on-site mobile laboratory. The laboratory will provide definitive quality data in accordance with regulatory-approved and standardized methods and quality assurance. Performance evaluation (PE) samples will be analyzed in the mobile laboratory and by an off-site referee laboratory.

Three samples from each mud pit representing the depth interval(s) where TPH and/or hexavalent chromium exceeds its preliminary action level will be submitted to an off-site fixed laboratory for TCLP-extractable volatiles, semivolatiles, and metals analyses. If the radiological screening results for the samples collected from pit 1D at UC-1 are significantly above background, those samples also will be analyzed for gross alpha/beta, gamma spectroscopy, and tritium by an off-site fixed laboratory. The off-site analyses will be performed by either Quanterra in St. Louis, Missouri, or LAS in Las Vegas, Nevada. A summary of the collected samples (including the estimated number of field duplicates) and the analytical methods to be used is presented in Table 4-1, and sample handling is discussed in Section 4.2.5. It should be noted that the sample numbers included in Table 4-1 are the maximum number to be collected inside the mud pits, based on sampling at all nine proposed sampling locations at each pit.

Table 4-1
CNTA Surface Sites Sampling Requirements

Sample Location	Number of Samples	Sample Type	Constituent of Concern	Analytical Method	Container Type and Volume Required	Preservative
Mud Pit Samples	625	Soil Grab	TPH	8015M, Diesel ^a	4- or 8-oz. glass with poly-lined cap	Cool to 4°C
Mud Pit Samples	625	Soil Grab	Total and hex. Chromium	7196 ^a , 7190	4- or 8-oz. glass	Cool to 4°C
Shaker Pad Area Soils	TBD	Soil Grab	TPH	8015M, Diesel ^a	4- or 8-oz. glass with poly-lined cap	Cool to 4°C
Shaker Pad Area Soils	TBD	Soil Grab	Total and hex. Chromium	7190 ^a	4- or 8-oz. glass	Cool to 4°C
Drilling Mud/Grout Piles	12	Soil Grab	TPH	8015M, Diesel ^a	4- or 8-oz. glass	Cool to 4°C
UC-1 Mud Pit 1D Samples	48	Soil Grab	Gross Alpha/beta Gamma spec Tritium	SM 7110 ^b HASL300 4.5.2.3 ^c EERF H-01 ^d	4-oz. glass or poly 8-oz. glass or poly 8-oz. glass or poly	none none none
Potential UST	4	Soil Grab	TPH	8015M, Diesel ^a	4- or 8-oz. glass	Cool to 4°C

^aEPA SW-846, *Test Methods for Evaluating Solid Waste*, 3rd Edition, modified according to the California State Water Resources Control Board, *Leaking Underground Fuel Tank Field Manual, Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure*, Appendix B (EPA, 1996b)

^bAmerican Public Health Association, *Standard Methods for the Examination of Water and Wastewater* (APHA, 1992)

^cU.S. Department of Energy *Environmental Measurements Laboratory Procedure Manual*, HASL-300 (DOE, 1992a)

^dEPA Eastern Environmental Radiation Facility (EPA, 1984)

TBD = To Be Determined through judgmental sampling of targeted areas

oz. = Ounce

°C = Degree(s) Celsius

Because areas outside the mud pits are not delineated by engineered structures such as berms, a judgmental (biased) sampling design will be used. Once a sample area has been selected, sampling will occur at two-foot depth increments from the top surface to a depth of 2.4 m (8 ft) (total of four samples at each location) unless specific depth intervals are indicated by geophysical measurements. A set of such samples will be taken at five locations: one at the center of the suspected spill or overflow area and four others at a distance of 3 m (10 ft) from the center location. Depending on the results of these 20 samples, additional samples at new locations and depths will be taken. Sampling will continue until the decision rule for TPH and hexavalent chromium indicates no further action. This may involve collection of samples at depths greater than 2.4 m (8 ft); however, the maximum depth of sample collection will be 6 m (20 ft).

4.2.2 Shaker Pad Area Investigation

Initial locations will be sampled at two-foot depth increments from the ground surface to four feet or to a different target depth if indicated by geophysical measurements. If a distinct layer of TPH contamination is found, either visually or by analysis, samples will be collected only from that depth interval and the underlying two-foot depth interval at subsequent sampling locations, as described in Appendix C. Table 4-1 includes the targeted analytes for the shaker pad areas. The total number of samples to be collected from the shaker pad areas cannot be estimated at this time due to the unknown extent of the sampling area.

4.2.3 Drilling Mud/Grout Piles

The samples will be collected with either a disposable or a decontaminated stainless steel trowel or spoon. Sample handling and analysis procedures will be the same as those described for the mud pits. Table 4-1 includes the estimated number of samples and targeted analytes for the drilling mud/grout piles.

4.2.4 Potential Underground Storage Tanks

If the two protruding pipes north of UC-3 are associated with a UST, two soil samples will be collected from outside the tank at the elevation of the bottom of the tank using the Geoprobe®. In addition, a hand auger will be used to collect two samples from inside of the tank, if possible. The samples will be analyzed for TPH by the on-site laboratory.

4.2.5 Sample Handling

Field QC will be maintained by performing all field activities in accordance with standardized operating procedures, quality practices, and guidance established in the QAPP (DOE, 1996). QC samples will be collected to analyze for possible contamination and to evaluate precision and accuracy of analysis associated with sample collection activities. Field duplicate, equipment rinsate blank, and field blank samples will be collected according to approved procedures and the QAPP. Each type of field QC sample will be collected and analyzed at a frequency of one per site or one per 20 samples at each site.

Soil samples will be handled, packaged, and shipped in accordance with approved procedures, SQP ITLV-0403, "Sample Handling, Packaging and Shipping" (IT, 1997). Shipping containers and filled sample bottles will be radiologically screened and shipped in accordance with U.S. Department of Transportation (DOT) regulations. Sample containers will be obtained from an

approved laboratory and certified clean per EPA protocol. Sample bottles will remain sealed until used.

Documentation of sampling events will be sufficient to demonstrate that samples have been obtained from the locations stated and that they have reached the laboratory without alteration except by required preservation. Field activities, sample collection, and sample custody will be documented in accordance with approved procedures, SQP ITLV-0401, "Field Activities Documentation" (IT, 1997) and SQP ITLV-0403, "Sample Handling, Packaging and Shipping" (IT, 1997). Custody refers to the method by which sample history is tracked and continuous possession of samples by approved custodians is documented. A legally defensible written record of sample custody from the time of collection through disposal will be maintained.

5.0 Waste Management Plan

Management of investigation-derived waste will be based on regulatory requirements, field observations, and the results of DOE-approved, laboratory analysis of site characterization samples. Administrative controls (decontamination procedures and characterization strategies) will minimize hazardous waste generated during site investigation activities.

Hazardous and/or mixed waste, if it is generated, will be managed and disposed of in accordance with DOE Orders, DOT requirements, NDEP regulations, RCRA regulations, agreements and permits between DOE and NDEP, and site-specific requirements. Decontamination activities will be performed according to approved procedures specified in the contractor field sampling instructions and will be written considering the contaminants of concern that are present at the site.

5.1 Waste Minimization

Characterization activities have been planned to minimize the amount of IDW generated. The planned field technique will generate minimal soil waste in the form of cuttings. Soil waste generated that does not require management as radioactive or RCRA-regulated waste will be left at the site and used in site recontouring operations and/or construction of berms. Other waste, such as disposable sampling and personal protective equipment, will be segregated to the greatest extent possible to avoid generation of hazardous, radioactive, or mixed waste. Hazardous materials will be controlled, minimizing generation of hazardous or mixed waste.

5.2 Potential Waste Streams

Based on preliminary sampling results of similar type sites and process knowledge, no mixed or transuranic waste streams are expected. It is likely that low-level, hydrocarbon, hazardous, and/or sanitary wastes will result from field activities. Potential waste constituents include tritium, other man-made radionuclides, petroleum hydrocarbons, and solvents used for sample extraction by the on-site mobile laboratory. Wastes generated during the surface investigation may include, but are not limited to:

- Decontamination rinsate
- Disposable sampling equipment (plastic, paper, sample containers, aluminum foil, etc.)
- Personal protective equipment (PPE)
- Spent samples and extraction media used by the on-site mobile laboratory

Wastes generated by laboratory operations will be managed separately from those generated by general site characterization activities. For example, waste PPE generated through contact with soil will be segregated from waste PPE generated from laboratory operations. In addition, spent samples and extraction media used by the on-site mobile laboratory will be segregated.

5.3 Sanitary Waste Management

Sanitary waste will be contained in plastic bags, dumpsters, or drums and transported to a sanitary waste landfill. Soils that are not regulated or are below low-level waste limits for radioactivity will be left on site.

5.4 Low-Level Waste Management

Low-level waste (LLW) will be managed in accordance with DOE Orders and the requirements of the *Nevada Test Site Defense Waste Acceptance Criteria, Certification, and Transfer Requirements*, NVO-325, Rev. 1 (DOE, 1992b). Liquid LLW, if any, will be evaporated on site. Solid IDW, such as sampling equipment and PPE, will be placed in plastic bags with an attached waste tracking tag in accordance with Standard Quality Practices. The bags will be placed in DOT-compliant drums (49 CFR 172), which will be properly labeled and locked or fitted with tamper-indicating devices. The drums will be staged at a designated Radioactive Materials Area pending disposal under NVO-325 criteria at the NTS (DOE, 1992b).

5.5 Hazardous Waste Management

Suspected hazardous wastes will be managed in accordance with RCRA and State of Nevada hazardous waste management regulations, interpreted as follows. Suspected hazardous wastes will be placed in DOT-compliant drums (49 CFR 172) which will be locked or fitted with tamper-indicating devices. The containers shall be compatible with the waste in accordance with the requirements of 40 CFR 265.172. Containers shall be handled and inspected in accordance with the requirements of 40 CFR 265.173 and 174, respectively. Based on process knowledge, incompatible wastes shall be managed in accordance with 40 CFR 265.177 (i.e., shall not be placed in the same container, and shall be separated such that in the event of a spill, leak, or release); incompatible wastes shall not contact one another. Wastes shall be containerized in a manner to comply with Subpart CC of 40 CFR 265.

Wastes shall be characterized in accordance with the requirements of 40 CFR 261.

Characterization will be based on laboratory results, process knowledge, or a combination thereof. Wastes pending characterization will be marked with "Hazardous Waste - Pending

Analysis" stickers until its regulatory status can be determined through evaluation of laboratory results. Waste shall be traceable to its source and/or samples considered analogous to the waste (such as waste drill core associated with a sample). Traceability shall be maintained by numbering containers and keeping appropriate records which trace waste to samples, areas, or products. After receipt of analytical results, hazardous wastes will be labeled and marked in accordance with the requirements of 40 CFR 262.32 and State of Nevada requirements such as writing the EPA Waste Code on the hazardous waste label.

Hazardous wastes will be accumulated at the site of generation for less than 90 days in accordance with 40 CFR 262.34. Prior to 90 days after the accumulation start date as specified in 40 CFR 262.34(a) or generation of wastes in excess of quantity limits specified in 40 CFR 262.34(c)(1), the waste will be shipped to a permitted hazardous waste treatment, storage, or disposal facility. The waste will be shipped by an appropriately licensed and permitted hazardous waste hauler. A Uniform Hazardous Waste Manifest shall be completed prior to shipping hazardous waste in accordance with the requirements of 40 CFR 262.20, 262.21, 262.22, and 262.23. A copy of the manifest shall be provided to the State of Nevada in accordance with state regulatory requirements.

5.6 Hydrocarbon Waste Management

Hydrocarbon waste (containing more than 100-parts per million total petroleum hydrocarbons) will be properly containerized in bags or drums and will be transported to an appropriately permitted hydrocarbon waste management facility after the waste is fully characterized.

5.7 Mixed Waste Management

Mixed waste shall be managed in accordance with RCRA (40 CFR 262) and State of Nevada (NAC 444) regulations as well as DOE requirements for radioactive waste, interpreted as follows. Where there is conflict in regulations or requirements, the most stringent shall apply. For example, the 90-day accumulation time limit and weekly inspections per RCRA regulations will be applied to mixed waste even though it is not required for radioactive waste. Conversely, while RCRA does not require traceability through the use of waste tracking tags, the waste acceptance program for LLW does; therefore, waste tracking tags shall be used for nonliquid waste. In general, mixed waste shall be managed in the same manner as hazardous waste. Suspected mixed waste will be managed in accordance with applicable regulations and requirements and will be marked with "Awaiting Analysis" stickers pending characterization and confirmation of its regulatory status. However, mixed waste shall be transported to the

Nevada Test Site transuranic waste storage pad for storage pending treatment or disposal.

Mixed waste with hazardous waste constituents below land disposal restrictions may be disposed of at the Area 5 Radioactive Waste Management Site under interim status. Mixed waste not meeting land disposal restrictions will require development of a treatment plan under the requirements of the Mutual Consent Order between DOE and the State of Nevada (Mutual Consent Agreement, 1995).

6.0 Time Frame and Reporting

6.1 Schedule

Field work will begin after the approval of this CAIP by the NDEP. Upon approval of this plan, NDEP will be notified of the scheduled start date for the field activities at least 10 working days prior to the start of field work. The expected completion time frame, in working days, is:

- Day 0: Mobilize surface geophysics crew to the site.
- Day 7: Mobilize conductivity logging probe and crew to the site.
- Day 14: Complete surface and intrusive geophysical surveys.
- Day 42: Mobilize sampling equipment and mobile laboratory and crews to the site.
- Day 70: Complete surface sites investigation.
- Day 101: Receive analytical performance evaluation results for on-site and referee off-site labs.
- Day 101: Quality-assured analytical data from the on-site laboratory is available.

Factors beyond DOE/NV's control, such as weather or delays in receipt of laboratory results, may delay field activities. If such delays occur, NDEP will be notified verbally.

6.2 Reporting

Within eight months of receipt of validated analytical results from the final field activities, a Corrective Action Decision Document will be submitted to NDEP. The document will, at a minimum, include the following:

- Drawings of the site, including appropriate site boundaries, sampling locations, estimated boundaries of contamination (if applicable), and other relevant features
- Discussions of the characterization methods used, including soil sampling methods, materials, and logs
- Information regarding the presence and concentrations of constituents of concern
- Tables summarizing laboratory and field-screening data

- Discussion regarding the adequacy of the characterization of the site
- Discussion regarding the quality control data obtained for the characterization
- Recommendations for further assessment, remediation, or closure of the site
- Photo documentation

In addition to the aforementioned scheduled deliverables, the DOE will notify the NDEP, as soon as is practicable, of any findings that will require the alteration of this plan or that will have a major impact on potential remedial action for the site and/or human health and the environment.

7.0 References

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Appendix A

Expedited Site Characterization Core Team Description

Core Team Composition:

The core decision-making team consists of a team leader and two or three technical support members.

Core Team Structure:

The core team, headed by a team leader, consists of three or four individuals with expertise in the scientific disciplines applicable to the site. For the purpose of the CNTA surface CAU corrective action investigation, the relevant scientific disciplines include geology, geophysics, environmental chemistry, and analytical chemistry. The core team leader is responsible, at a minimum, for revisions to the conceptual site model, for the in-field decisions that incorporate core team members' views prior to deciding on the next sequence of measurements, and for deciding when the site characterization objectives have been achieved. The core team members manage the field activities within their respective areas of expertise, provide interpretations of the characterization results to the other core team members, and implement the core team leader's decisions. A core team member can serve in more than one area of expertise if site characteristics permit, but in no case should the core team consist of a single person. It is a key ESC concept that the exchange of views within a multidisciplinary team ensures on-site peer review of the evolving conceptual site model. The core team is supported by appropriate on-site and off-site personnel.

Core Team Responsibilities:

The core team members are responsible for the following:

- Project scoping
- Preparing a dynamic work plan that allows for on-site decision-making
- Selecting site characterization technologies and qualified technology providers appropriate for implementing the project
- Continuously directing and managing the ESC field activities, including the activities of other field team members (e.g., the logistics coordinator, direct push operations, sampling crews, geophysical investigations, etc.)

- Communicating field ESC results to the client
- Preparing the final report

It is a key to ESC's previous successes that the same core team members who are involved in the site planning also are involved in the field when field activities relevant to their core competency are occurring. Only the core team leader is necessarily involved continuously in all ESC field phases.

Core Team Qualifications:

Core team leader: The core team leader should be a mid- to senior-level individual with extensive training and experience in one or more of the scientific disciplines applicable to the site. The core team leader also must have extensive experience in managing and directing multidisciplinary teams and in all elements and functions of contaminated site characterization projects.

Core team member: A core team member should be a mid- to senior-level individual with extensive training and experience in one of the scientific disciplines applicable to the site. In addition, a core team member must be able to communicate well with other team members with complementary technical expertise. Areas of expertise may include soil science, geology, geophysics, hydrogeology, geochemistry, analytical chemistry, environmental chemistry, or any other discipline central to understanding the site characteristics.

Appendix B

Historical Information

SPECIFICATIONS FOR
BENTONITE AND CHEMICALS
UC-3 AND UC-4

The specifications were prepared for the United States Atomic Energy Commission, Nevada Operations Office, by Fenix and Scisson, Inc., and Petroleum Consultants, a joint venture for the execution of United States Atomic Energy Commission A-E Contract AT(26-1)-38.

Specifications for bentonite and chemicals to treat drilling fluids required to drill holes UC-3 and UC-4, Central Nevada Test Site, are as follows:

<u>Item</u>	<u>Description</u>
Bentonite	Selected, finely ground, montmorillonite clays. To be used to form a colloidal gel that controls viscosity, gel strengths, and filtration. Must conform to API Std. 13A, dated March 1966.
Chrome Lignosulfonate	A non-caking water soluble powder to be used as a chemical thinner for drilling muds. Lowers mud viscosity, gel strengths and improves filtration properties. Supplied in 50 pound multi-wall paper bags.
Chrome Lignite	A water soluble powder to be used as a chemical thinner for drilling muds. Aids the chrome lignosulfonate in improving viscosity and gel strengths. Aids in controlling the fluid loss property of drilling mud at elevated temperatures and pressures. Supplied in 50 pound multi-wall paper bags.
Caustic Soda	Flake form, domestic, commercial grade, 98.06% sodium hydroxide, Ph 12.6, supplied in 100 pound metal drums.
Soda Ash	Light type, grayish white powder, commercial sodium carbonate, 58% Na_2O , in accordance with ASTM designation D-452-57. Supplied in 100 pound multi-wall paper bags.
Mica	Flakes of mica that can be used when lost circulation is anticipated. The fine particles will pass the shaker screen. Aids in establishing circulation when mud returns have been lost. Aids in building a good wall cake.
Fine Mica	35% retained on 40 mesh screen 30% retained on 60 mesh screen 20% retained on 80 mesh screen
Coarse mica	30% retained on 10 mesh screen 35% retained on 20 mesh screen 15% retained on 40 mesh screen
	Supplied in 50 pound multi-wall paper bags.

Item

Description

Cane and Wood Fiber

A mixture of cane and wood fibers for preventing or overcoming lost circulation. Treated to resist decomposition. Non-abrasive. Supplied in 40 pound multi-wall paper bags.

Coarse Cedar Fiber

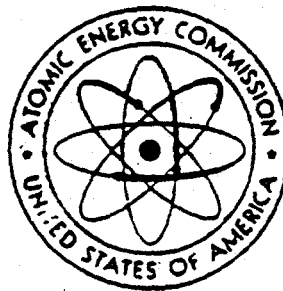
A fiberized redwood that does not rot, deteriorate or sour when mixed with drilling mud. To have good matting and bridging properties. Supplied in 40 pound multi-wall paper bags.

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NVO-151


SUMMARY REPORT CENTRAL NEVADA TEST AREA DEMOBILIZATION AND RESTORATION ACTIVITIES



DECEMBER 1974

UNITED STATES ATOMIC ENERGY COMMISSION
NEVADA OPERATIONS OFFICE
Las Vegas, Nevada

Prepared By


HOLMES & NARVER, INC.
ON-CONTINENT TEST DIVISION
Las Vegas, Nevada

fencing, have been removed and the area cleaned up. Underground water, sewer, electrical, signal, and telephone lines were abandoned in place. This area is located inside the UC-3 land withdrawal which NV is retaining.

a. Scientific Cableway (RTP to Ground Zero)*

Fencing was removed and a parallel drainage ditch was backfilled (refer to Figure 11).

b. Trash Dump (West of the RTP)*

Trash that high winds had scattered was returned to the dump. Additional trash was added after which the entire pit was backfilled.

3. UC-3, Ground Zero Area**

This area is being retained by NV. It remains fenced (perimeter fence only). Work accomplished to date includes the following:

a. Removal of the inner security fence.

b. Capping of the large diameter UC-3 emplacement and and canister holes with heavy concrete slabs over existing steel plates. (See Figures 12, 13, and 14.)

c. Plugging of other drilled holes (refer to Section II, paragraph C).

d. Removal of all aboveground structures except for two technical buildings (long buildings) and two generator shelters which were transferred in place to the U.S. Navy in exchange for the Navy's removal from this site. Other buildings and aboveground facilities were disposed of either through public sale or transfer to other NV contractors and/or to other government agencies.

e. A large quantity of scrap iron, resulting from drilling operations, was removed via a public sale.

f. Sumps previously used to contain drilling mud and water were used for trash dumps and then were backfilled.

g. An initial cleanup has been made, principally around the emplacement hole or the eastern half of the fenced area.

9. Borrow Area (Aggregate Site C)**

NAR

10. Central Pipe Yard*

Scrap metal was disposed of through a public sale of ferrous iron. The hillside to the west was cleaned up (refer to Figure 15). Salvable equipment from other areas was moved inside the fence. Drill casing stored outside the fence was moved inside (see Figure 16). A completion report was prepared and signed off except for the fenced area which NV is retaining as a storage yard. During June and July of 1974, a large amount of drilling equipment was moved to the NTS.

11. Area UC-1, Faultless Site*

With BLM's concurrence, a plan to erect a concrete monument was canceled in favor of installing a bronze tablet directly on the 88-inch diameter surface pipe used originally for the drill rig's cellar. This pipe, along with inner casing strings, is approximately nine feet higher than the land surface. Prior to the event, the top of the pipe was flush with the ground surface. This change in relative elevations resulted from differential subsidence after the event. The surface pipe serves as an interesting monument that was directly involved with Project Faultless (see Figures 17 and 18).

Although NV will continue to retain this site, the BLM has concurred with NV's cleanup and demobilization effort by signing a completion report.

Demobilization activity included the following:

- a. A radiological survey (see Section III-B).
- b. Removal of perimeter and GZ fencing.
- c. A general cleanup including backfilling of sumps used for drilling mud and water.
- d. The plugging, capping, and/or marking of all other bore holes in the area except those used for long-term monitoring programs.
- e. Removal and disposal of signal and coaxial cables.
- f. Removal of projecting emplacement casing and its "strongback" support above the Faultless emplacement hole and the filling of remaining voids with concrete.

12. Recording Trailer Park (RTP) for UC-1*

The area was cleaned up, steep drainage ditch slopes were improved, and back boards were removed.

13. Central Mud Pit**

A mud pump and other salvable equipment was moved to the Central Pipe Yard. A large equipment pit was backfilled. The berm surrounding partially dry mud was opened to prevent future accumulations of water. This will further dry the drilling mud to allow backfilling at a future date. The fence was retained (refer to Figures 19 and 20). The pit is within the UC-1 land withdrawal which NV is retaining.

a. Decontamination Facility Pit (UC-1)*

A rad-safe survey found no radioactivity (see Section III-B). The fence was removed and the pit backfilled.

14. Borrow Area (approximately one-half mile north of the Central Pipe Yard)**

NAR

15. UC-4 Ground Zero Area*

The shaker plant's bulkhead was removed. All mud pits except one were backfilled (refer to Figures 21 and 22). The emplacement hole had previously been capped by welding a two-inch thick steel plate to the surface conductor pipe (see Figure 23). Additionally, a heavy concrete slab was poured over the plate (see Figure 24). The area was cleaned up. Perimeter fencing, 41 each 60-foot long joints of 54-inch diameter hole casing remain at UC-4. Although NV will retain this area, the BLM has accepted all work accomplished to date by signing a completion report. The berm surrounding the remaining mud pit was cut to prevent water accumulation and expedite drying. Refer to Figures 25 and 26 for drilling operations and Figure 27 for the demobilized site.

16. Contractors Camp Site (Near Moores Station)**

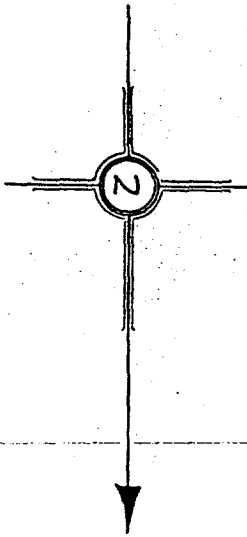
NAR. (The culvert pipe near this area and mentioned in NVO-90 was hauled to a dump.)

17. Moores Station**

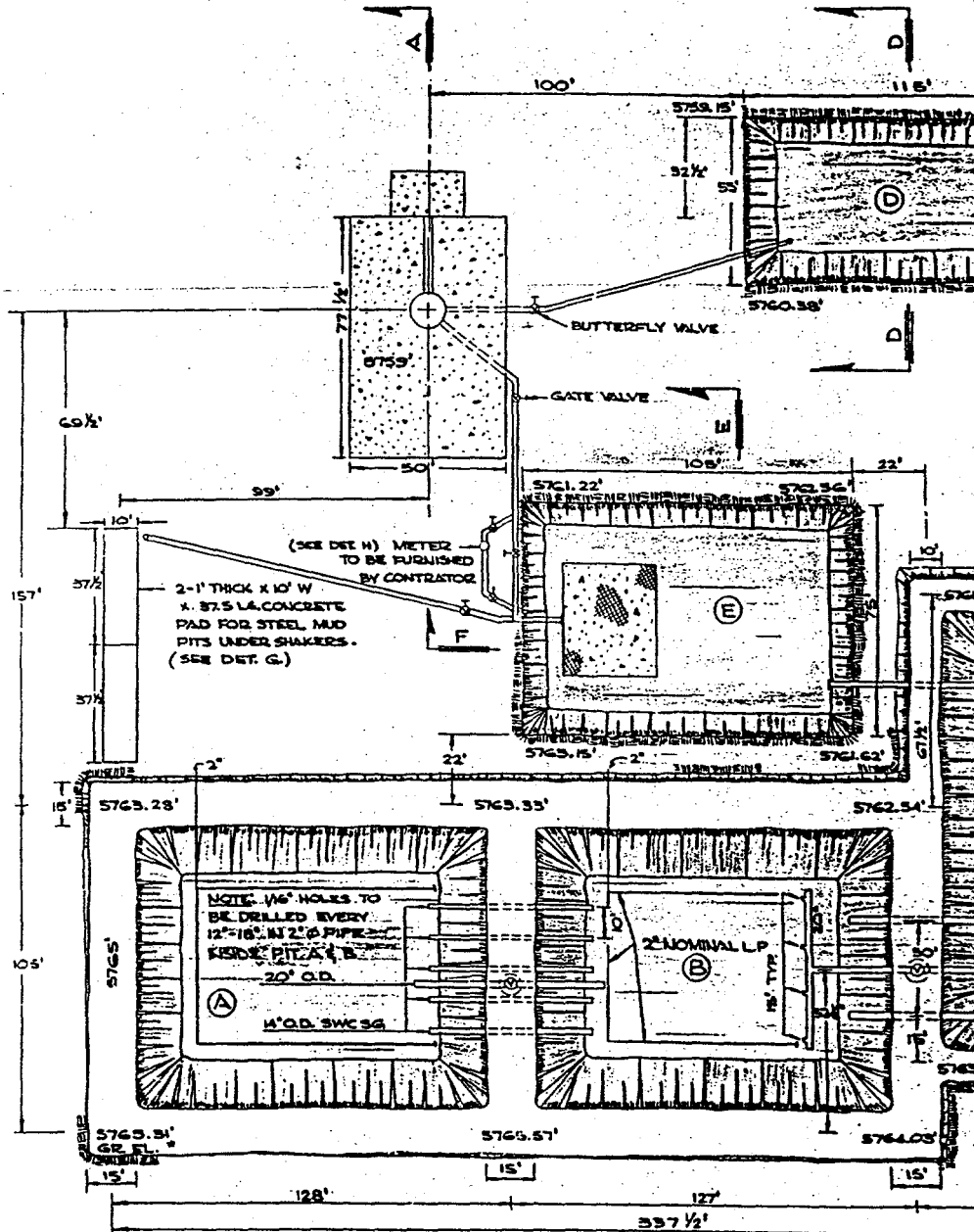
NAR

18. UCE-18, Water Supply Well*

See paragraph C-1 for methods used to test and plug this hole. Other work included: removal of fencing, hauling salvable equipment and material to the Central Pipe Yard (see Figures 28 and 29), backfilling the water sump, disposal of nonsalvable lean-to shelters, transfer of a 10,000-gallon diesel tank to the AFSC, and cleanup of the area.



DRAINAGE DITCH



NOTE: *
(ALL ELEVATIONS SHOWN ON PIT CORNERS ARE EXISTING
GROUND LEVELS. ALL OTHER ELEVATIONS
SHOWN IN TABLES ARE FINISHED GRADES)

SCALE: 1" = 30'

GENERAL NOTES

1. R/S PAD DETAILS CAN BE OBTAINED FROM F & S DRAWING NO. LV-86
2. ALL PIPING BETWEEN EARTH PIT, R/S PAD AND STEEL PIT, STEEL PIT AND EARTH PIT, IS GOVERNMENT FURNISHED.
3. FLUID METER FOR 5000 GPM IS DRILLING CONTRACTOR FURNISHED.

A. EARTH PIT CONSTRUCTION

1. EARTH PITS ARE TO BE EXCAVATED AS FOLLOWS:
PIT-A. TOP OF WALL 5765' TO A DEPTH OF 5755'
PIT-B. TOP OF WALL 5765' TO A DEPTH OF 5752.5'
PIT-C. TOP OF WALL 5765' TO A DEPTH OF 5752'
PIT-D. FROM GROUND LEVEL TO A DEPTH OF 10'
PIT-E. FROM GROUND LEVEL TO A DEPTH OF 6.5'
2. THE TOP 2' OF SOIL ONLY IS TO BE USED IN THE CONSTRUCTION OF THE PIT WALLS. ALL OTHER SOIL UNSUITABLE FOR CONSTRUCTION AND SHOULD BE EXCAVATED AND REMOVED FROM THE LOCATION AS DIRECTED BY THE CONTRACTING OFFICER. IF ADDITIONAL DIRT IS REQUIRED FOR PIT WALL CONSTRUCTION BORROW PIT WILL BE DESIGNATED BY CONTRACTING OFFICER OR HIS REPRESENTATIVE.
3. EARTH PIT WALLS MUST BE COMPACTED. THE MAXIMUM DRY DENSITY OF THE TOP 2' OF SOIL IS 133.4 LBS. PER CU. FT. AND IS TO BE COMPACTED BY THE USE OF A SHEEP'S-FOOT W/MAX. 6" LIFTS TO 95% CONTROLLED COMPACTION OPTIMUM MOISTURE CONTENT IS 7.5%. DENSITY TESTS ARE TO BE RUN DURING COMPACTION AND SHOULD COMPLY WITH SPECIFICATIONS OF A.S.T.M.-D-1556. TOP OF ALL WALLS TO BE AT ELEVATION OF 5765'.
4. SLOPE OF ALL WALLS TO BE 1 1/2' TO 1'.
5. A LIGHT MIXTURE OF BENTONITE SHOULD BE SPRAYED ON THE WALLS AND BOTTOMS OF PITS A, B, AND C BEFORE FILLING WITH WATER, APPROX. 20 LBS. OF BENTONITE PER BARREL OF WATER. COVERAGE = 250 SQ. FT. / BARREL.
6. A KEYWAY IS TO BE MADE UNDER ALL EARTH PIT WALLS AT THE FILL-GROUND LEVEL INTERFACE. CUT AN 8" WIDE 1' DEEP TRENCH. LINE BOTTOM WITH BENTONITE, FILL WITH 6" LIFT AND COMPACT WITH SHEEP'S-FOOT. LINE AGAIN WITH BENTONITE, FILL AND COMPACT.
7. 20" BYPASS LINE FROM MUD PIT TO SHALE SHAKER TO BE BURIED AND STUBBED W/ 90° ELL. LOOKING UP AT THE SHALE SHAKERS
8. 2" LINES INTO PITS A & B ARE TO BE FIELD FITTED. LINES TO BE CONNECTED AT A LATER DATE TO DRILLING CONTRACTOR'S AIR COMPRESSORS
9. DRAINAGE DITCH TO BE CUT WITH MOTOR PATROL 6" WIDE 8" DEEP

B. CONCRETE IN PAD

1. ALL CONCRETE SHALL HAVE MINIMUM COMPRESSION STRENGTH OF 3000 PSI IN 7 DAYS AND SHALL CONFORM TO A.C.I. CODE 318-63
2. REINFORCING STEEL SHALL BE INTERMEDIATE GRADE AND SHALL CONFORM TO A.S.T.M. SPEC. A-15 WITH DEFORMATIONS CONFORMING TO ASTM SPEC. A-805. PLACEMENT BARS SHALL CONFORM TO A.C.I. CODE 318-63.

C. PIPING INSTALLATION

1. ALL PIPE SHALL BE FLAME END WELDED SCHEDULE 20 LINE PIPE OR EQUAL.
2. ALL VALVES ARE FLANGED.
3. ALL VALVE BOXES ARE 7" DIAMETER CORRUGATED METAL PIPE WITH 1" OF LOOSE GRAVEL IN BOTTOM.
4. ALL CONNECTIONS SHALL BE FIELD WELDED IN ACCORDANCE WITH FOMR (SCISSON INC. FIELD WELDING STANDARDS, ISSUED MARCH 21, 1964).

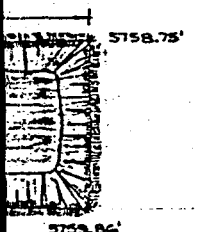
BILL OF MATERIALS

1. 675'-20" O.D. LINE PIPE SCHEDULE 20, RE. BEVEL FOR WELDING,
2. 7 EACH VALVES, 20" BUTTERFLY, DEWCO SERIES HW OR EQUAL, 125 PSI K.R. WITH WORM GEAR OPERATOR, ADD THE FOLLOWING STEM EXTENSIONS 48"-5, 120"-2
3. 1 EACH VALVE, 20" GATE, FLANGED, 125-LB. CRANE NO. 44 OR EQUAL, WITH WORM GEAR OPERATOR
4. 14 SETS (52) - FLANGES, 20" NOMINAL, 125-LB. SUP-ON, FLAT FACED, COMPLETE W/NUTS, BOLTS, AND GASKETS (EQUAL TO TUBE-TURN PART NO. 77).
5. 20'-10" O.D. LINE PIPE, SCHEDULE 20, R.E.
6. 240'-10" O.D. CASING, SPIRAL WELD.
7. 240' CU. YDS. - CONCRETE, 3000 PSI IN 7 DAYS.
8. 1080 SQ. FT. - 6" X 6" 10/10 WIRE MESH.
9. 700' LIN. FT. - 6" BAR; 1320' LIN. FT. - 8" BAR.
10. 32 LIN. FT. - 7" DIA. CORR. METAL PIPE (FOR VALVE BOXES).
11. 2 EACH TROUGH; STEEL, 24" WIDE X 60" HIGH X 40' LONG WITH 2 X 2 ANGLE BRACES OPEN TOP.
12. 1-TEE-20" O.D. NOMINAL (EQUAL TO TUBE-TURN PART NO. 20).
13. 300'-2" NOMINAL T (C LINE PIPE, 375 LBS./FT. 11 1/2" THREAD, SCHED. 40
14. 3-20" O.D. NOMINAL 45° ELBOW, LONG RADIUS (EQUAL TO TUBE-TURN PART NO. 5)
15. 2-20" O.D. NOMINAL LATERAL (EQUAL TO TUBE-TURN PART NO. 26)
16. 1-20" O.D. NOMINAL 90° ELBOW, LONG RADIUS (EQUAL TO TUBE-TURN PART NO. 1)

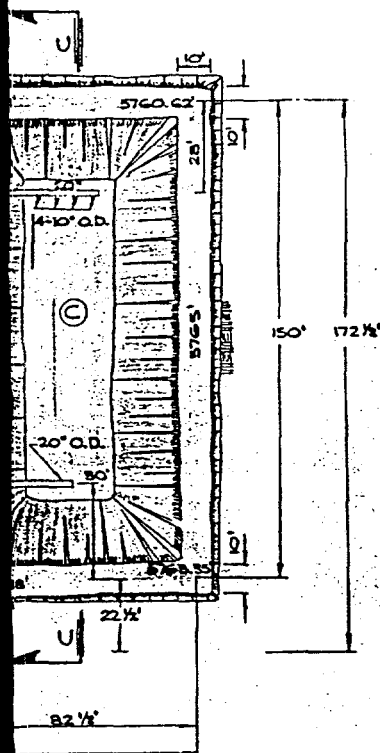
FLUID LEVEL	ELEVATIONS	PLUS OR MINUS
PIT-A	5765'	+4.0'
PIT-B	5761.5	+2.5'
PIT-C	5760'	+1.0'
3-6" X 10' X 58' STEEL MUD PITS	5758.5'	-0.5'
PIT-D	5749'	-10.0'
SHAKES PITS	5740.5'	+11.5'

EXCAVATION	TOP 2' GOOD SOIL	BELOW 2' WASTE
PIT-A 784 CU. YDS.	2,620 CU. YDS.	
PIT-B 784 "	3,040 "	
PIT-C 725 "	2,970 "	
PIT-D 510 "	2,230 "	
PIT-E 585 "	1,580 "	
	3,285 CU. YDS.	12,440 CU. YDS.

SOIL REQ'D FOR WALLS, 1200 CU. YDS., TO BE TAKEN FROM THE TOP 2' OF SOIL EXCAVATED. 12,440 CU. YDS. OF WASTE SOIL TO BE REMOVED FROM LOCATION AS DIRECTED BY THE CONTRACTING OFFICER OR HIS REPRESENTATIVE. ALL VOLUMES CALCULATED ARE APPROX.



CLEARANCE BETWEEN PIT D & E 10' APPROX.



R/S PAD	ELEVATIONS	PLUS OR MINUS
4. INLET FLOW LINE	5759'	0.0'
4. HOLE OVER-FLOW LINE	5755'	-4.0'
BOTTOM OF 3-6" X 10' X 58' STEEL MUD PITS	5755'	-4.0'
BOTTOM OF CENTRIFUGAL PUMP SHDS	5754.5'	-4.5'
TOP OF 3-6" X 10' X 58' STEEL MUD PITS	5754'	-5.0'
TOP OF EARTH PIT WALLS A, B, C.	5760'	+1.0'
BOTTOM OF 2-7' X 8' X 80' STEEL MUD PITS	5765'	+6.0'
TOP OF SHALE SHAKERS	5765.5'	+6.5'
R/S FLOOR	5787'	+28.0'

NO.	DATE	REVISIONS	BY	CR	A.E.	APP.
1	5/25/64	DRAWG. LV. 87 (4-15-63) COMPLETELY REVISED.	J.R.			

U. S. ATOMIC ENERGY COMMISSION		LAS VEGAS, NEVADA	
NEVADA OPERATIONS OFFICE			
DESIGNED J. GIBBS	MUD PITS & SECTIONS		
DRAWN J. REZA			
CHECKED J. H. HARRIS			
APPROVED J. H. HARRIS			
SUBMITTED J. H. HARRIS	AGENCY APPROVAL	APPROVED J. H. HARRIS	DATE 5/25/64
FENIX & SCISSON, INC.		L.S. NO.	DRAWING NUMBER
ENGINEERS AND CONTRACTORS			LV-87
LAS VEGAS, NEVADA			REV. 1

Appendix C

Sampling and Analysis Design

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C.1.0 Optimization of the Design for Collecting Data

C.1.1 Statistical Design for Inside Mud Pits

The sampling program for the mud pits has been designed to provide sufficient data to allow statistical determination of whether or not targeted analytes are present in the mud pits in concentrations that exceed preliminary action levels. This determination will be made using the procedures described in Chapter 6 of the EPA publication *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media* (EPA, 1989). For each mud pit, the mean concentration (or activity for radionuclides in the UC-1 mud pits) and standard deviation of each targeted analyte in the mud pit soils will be used to calculate the number of samples necessary to make that determination at the 90 percent confidence level (equivalent to the decision error rate goal discussion in Section 3.4.6.1 of the CAIP) using the following equation (equation 6.6 from the EPA, 1989, document).

$$n_d = s^2 \left(\frac{z_{1-\beta} + z_{1-\alpha}}{Cs - \mu_1} \right)^2 \quad (1)$$

Where:

- n_d = number of samples;
- s = standard deviation of the sample population;
- α = false positive rate;
- β = false negative rate;
- $z_{1-\alpha}$ = critical value for normal distribution with a probability of $1-\alpha$;
- $z_{1-\beta}$ = critical value for normal distribution with a probability of $1-\beta$;
- Cs = the cleanup standard (or action level); and
- μ_1 = mean concentration of contaminant.

By using $z_{1-\alpha}$ and $z_{1-\beta}$ values (usually available from statistics text books) for $\alpha = \beta = 0.10$ (the 10 percent decision error rate goal for the project), the number of samples that need to be collected to make the determination at the 90 percent confidence level can be calculated. If the calculated number of samples is less than or equal to the number of samples actually collected, no additional samples would be required to support the decision with no more than a 10 percent chance of making a decision error. If the calculated number of samples is greater than the

number actually collected, then either additional samples can be collected to meet the decision error goal, or the decision could be made with the level of confidence calculated for the number of samples collected.

The TPH analytical data collected in 1995 from the Central Mud Pit (Table 2-3 in the CAIP) can be used to illustrate the process. A total of ten samples was collected from the surface and near-surface of the mud pit, four from the 0- to 3-inch depth interval (samples 1A, 3A, 4A, and 5A), one from the 3- to 6-inch depth interval (sample 2A), one from the 18- to 21-inch depth interval (sample 1B), and four from the 20- to 23-inch depth interval (samples 2B through 5B).

Assuming that the top two feet of the drilling mud is homogeneous (i.e., there is no stratification of TPH contamination, and the analytical results are representative of the top two feet of mud), the data can be used to calculate how many samples would be required to determine whether TPH concentrations in the top two feet of drilling mud exceed the TPH action level with no more than a 10 percent chance of making a decision error (α and $\beta = 0.10$). The values for the equation variables are:

$$n_d = s^2 \left(\frac{z_{1-\beta} + z_{1-\alpha}}{Cs - \mu_1} \right)^2 \quad (2)$$

Where:

μ_1 = 376.9 mg/kg (the mean TPH concentration for the ten samples);

s = 258.77 mg/kg (the standard deviation for the ten samples);

Cs = 100 mg/kg (the preliminary action level for TPH, as discussed in Section 3.4.3.3 of the CAIP);

$z_{1-\alpha}$ = 1.282 (for $\alpha=0.10$); and

$z_{1-\beta}$ = 1.282 (for $\beta=0.10$).

Using these values in the equation above, the number of samples needed to make the determination (n_d) at the specified confidence level is 5.74, rounded up to 6. Since 10 samples were collected, no additional samples are needed to make the determination with no more than a 10 percent chance of a decision error (the determination would be that the mean concentration of TPH in the uppermost two feet of drilling mud exceeds the preliminary action level for TPH). It should be noted that the equation is applicable to normally distributed data. Although the

distribution of data for the mud pits is unknown, Gilbert (1987) indicates that the arithmetic mean (normal distribution) is a reasonable estimator of the true mean when the coefficient of variation (sample standard deviation divided by sample mean) is less than 1.2. Since the coefficient of variation for the above example is approximately 0.93, the assumption of normality appears to be reasonable.

It should be noted that the closer the mean concentration is to the action level or the greater the standard deviation (or both), the greater the number of samples needed to make the determination. In addition, the false positive (α) and false negative (β) rates specified for the statistical calculations also affect the number of samples needed. As a result, the number of samples needed to make the determination for other mud pits may not be the same as the number needed for the top two feet of the Central Mud Pit.

C.1.1.1 Sampling Approach for Inside Mud Pits

The sampling and analysis program for the CNTA mud pits is designed to support the statistical analysis described above. For each mud pit, the number of samples (six) calculated for the top two feet of the Central Mud Pit will be used as a starting point for the number of locations to be sampled. Samples will be collected at two-foot intervals at each location in each mud pit to allow determination of whether contamination is stratified with every two-foot depth increment in each mud pit treated as a separate layer for the purpose of the statistical evaluation (i.e., six samples will be collected from each two-foot depth interval in each mud pit). One sample also will be collected from the native soils below the mud pit at each sampling location.

Due to the lack of data for the mud pits other than the Central Mud Pit and the uncovered mud pit at UC-4, the actual number of samples needed for each mud pit to support application of the decision rules at a 90 percent confidence level is unknown. The most efficient and cost-effective approach to addressing this uncertainty is to use field analytical methods because these methods will provide "real-time" data which will allow continuous calculation (or recalculation) of the number of samples needed to support application of the decision rules at the specified confidence level without having to wait for results from an off-site fixed laboratory. Due to the sensitivity of the statistical calculation to the difference between the mean measured concentration and the preliminary action level and to the standard deviation of the mean, it is important to select field analytical methods that are capable of measuring contamination at levels well below the preliminary action levels. Because of this, the field analytical method selected for the mud pit

investigation is a mobile on-site laboratory capable of performing the same analytical method for TPH and chromium as an off-site fixed laboratory would use (SW-846 Method 8015 modified for TPH [EPA, 1996b], x-ray fluorescence spectrometry [XRF] and flame atomic absorption [FLAA] for total chromium [SW-846 Method 7190], and SW-846 Method 7196 for hexavalent chromium). An additional benefit of using the same method as an off-site lab is that the number of samples which need to be sent to an off-site fixed laboratory for confirmation analysis will be minimized.

Based on the available information, including the TCLP data from the 1995 DOE sampling event (Table 2-3 in the CAIP), the distribution of chromium concentrations with respect to whether it exceeds preliminary action levels is expected to closely follow the distribution of TPH concentrations. To confirm this assumption, chromium will be quantified on site by analytical methods designed to be definitive.

Based on these considerations, the general sampling and analysis approach for each mud pit is:

- Collect samples at two-foot depth intervals from six locations within each pit.
- Analyze the samples for TPH and hexavalent chromium at the mobile laboratory.
- For each two-foot depth interval, calculate the number of samples needed to determine whether the mean concentration of TPH or hexavalent chromium exceeds the preliminary action levels of 100 mg/kg and 400 mg/kg, respectively.
- If the calculated number of samples is less than or equal to the number of samples actually collected, no additional samples will be needed to support application of the decision rules.
- If the calculated number of samples is greater than the number actually collected, but is less than nine, collect additional samples from the depth interval so that the number actually collected is equal to the number calculated.
- If the calculated number of samples is greater than the number actually collected and is greater than nine, collect additional samples from the depth interval so that the total number of samples actually collected is nine.
- Recalculate the number of samples needed.

- Repeat the sequence of sample collection, analysis, and recalculation of the number of samples needed until the calculated number of samples is less than or equal to the number of samples collected or until a total of nine samples has been collected.

The upper limit of nine locations per mud pit is intended to allow evaluation of other options in addition to continued sampling to support application of the decision rules. These options include:

- Continue sampling until the calculated number of samples is equal to or less than the number collected.
- Modify the decision error goals so that the calculated number of samples is equal to or less than the number collected.
- If one sample concentration is significantly greater than (or less than) the concentrations in the other samples from the depth interval, treat the one concentration as an outlier.
- Base a decision for the depth interval on data from the adjacent depth intervals. For example, if the data from the interval immediately above support an "exceeds action levels" decision and the data from the depth intervals below support a "does not exceed action levels" decision, then the uncertain depth interval could be included with the overlying "exceeds action levels" interval(s) for the purpose of evaluating remedial options.

A flow chart showing the decision process for each two-foot depth interval for each mud pit is presented in Figure 3-1 in the CAIP.

The samples collected from the native soils below the mud pits will be archived at the mobile laboratory (for TPH and hexavalent chromium analysis). If the deepest sample of drilling mud at a sampling location contains TPH and/or hexavalent chromium above their respective preliminary action levels, these archived samples will be analyzed to allow evaluation of whether or not the contaminant has migrated into the native soils. In addition, for each mud pit, three samples representing the depth interval(s) where TPH and/or hexavalent chromium exceeds its preliminary action level will be sent to a fixed off-site laboratory for TCLP-extractable volatile and semivolatile organic compound and metals analyses to allow evaluation of remedial options.

As noted in Section C.1.1, additional samples for TPH analysis are not needed from the top two feet of the Central Mud Pit. As a result, samples collected from the top two feet of that pit will

be analyzed for hexavalent chromium only in accordance with the procedure described in Section C.1.3.

It is also unknown whether the small mud pit near the Central Mud Pit (CAS No. 58-09-02) and the mud pit near HTH-1 (CAS No. 58-09-04) actually are mud pits or whether they are borrow pits (until decided otherwise, they will be referred to as mud pits). Two samples will be collected from the small mud pit near the Central Mud Pit and three from the mud pit near HTH-1 for TPH and hexavalent chromium analysis by the mobile laboratory. If the samples collected from these pits physically appear to be the same material as is contained in the known mud pits or if TPH or hexavalent chromium is detected in the samples above preliminary action levels, the sampling and analysis process described above will be implemented in these pits. If it is determined that the material in these pits is not drilling mud, no further sampling will be performed.

C.1.1.2 Sampling Approach for Outside Mud Pits

Because areas outside the mud pits are not delineated by engineered structures such as berms, a judgmental (biased) sampling design will be used. Once an area has been selected, as indicated in the decision rule for areas outside the mud pits, sampling will occur at two-foot depth increments from the top surface to a depth of 2.4 m (8 ft) (total of four (4) samples at each location) unless specific depth intervals are indicated by geophysical measurements. A set of such samples will be taken at five locations: one at the center of the suspected spill or overflow area and four others at a distance of 3 m (10 ft) from the center location. Depending on the results of these 20 samples, additional samples at new locations and depths will be taken. Sampling will continue until the decision rule for TPH and hexavalent chromium indicates no further action. This may involve collection of samples at depths greater than 2.4 m (8 ft); however, the maximum depth of sample collection will be 6 m (20 ft). Once the horizontal and vertical limits of the contaminated area have been delineated, the statistical calculation used for inside of the mud pit berms will be used to verify that sufficient samples have been collected from within the contaminated area to support application of the decision rules.

C.1.2 Shaker Pad Areas

The shaker pad area investigation is designed to determine whether or not any of the spilled mud can be found and, if it is, to allow determination of whether targeted analytes are presented in concentrations that exceed preliminary action levels and to determine the vertical and horizontal.

extent of the targeted analytes. The same statistical design that is described above for the mud pits will be used for each shaker pad area once the horizontal and vertical limits of the contaminated area have been established. The initial effort to locate the spilled mud will involve geophysical studies (described in Section 4.1).

Areas and depth intervals identified by the geophysical investigation or visual observations as potential locations of surficial or subsurface drilling mud will be sampled on a judgmental basis. Samples will be collected at two-foot increments from depth intervals identified by geophysical measurements. If no depth interval information is available, samples will be collected at two-foot increments from the ground surface to a depth of four feet at these locations. These samples will be analyzed for TPH and hexavalent chromium by the on-site mobile laboratory. If TPH and hexavalent chromium are not detected in any of the initial samples from a shaker pad area, no additional sampling will be conducted at that area. If TPH or hexavalent chromium is detected in any of the samples at an area, additional samples will be collected within the area identified by geophysical measurements with the locations determined on a judgmental basis. These samples will be collected from the depth interval or intervals in which TPH or hexavalent chromium was detected and from the depth interval immediately underlying it. Sampling will proceed on a judgmental basis to determine the vertical and horizontal extent of the target analyte(s).

C.1.2.1 Drilling Mud/Grout Piles

The primary objective of the drilling mud/grout piles investigation is to determine whether the material present in the piles is drilling mud, cement grout, or a mixture of both. Because of this, the sampling approach is to collect two samples from each drilling mud/grout pile and analyze them for TPH and hexavalent chromium using the mobile laboratory. If TPH or hexavalent chromium is detected at levels that exceed their respective preliminary action level (see Section 3.4.3.3 of the CAIP) in either sample from a pile, an additional sample will be collected from that pile for off-site TCLP-extractable chromium to allow evaluation of disposal options. In addition, a visual inspection will be made of the pile area, and if evidence is found for migration of material or contaminants, then judgmental sampling of these areas will be conducted. If the material in any of the piles is solidified cement, that pile will not be sampled.

C.2.0 On-Site Analytical Strategy

C.2.1 TPH (diesel)

Because the bottleneck in sample analysis most often occurs in the extraction process, it is imperative that the most effective technologies currently available be used to increase production, especially when operating on site in the ESC mode. For this reason, EPA method 3545, Accelerated Solvent Extraction (ASE), for sample extraction will be used on site (EPA, 1996b). This method will significantly increase overall sample throughput, minimize solvent waste, and increase overall production. TPH of the aliquots will be determined by EPA SW-846 Method 8015 modified (EPA, 1996b). Without a concentration step, 30-gram soil samples will provide a practical quantitation limit of 10 parts per million.

The daily throughput of TPH sample analysis (based on a 12-hour day) will be increased from 10 to 12 samples per day to approximately 15 to 18 samples per day. In addition, the automation of this system will help free an otherwise dedicated extractionist to assist with other tasks.

C.2.2 Chromium

The analysis of chromium will be performed using three methods based on the following rationale:

X-Ray Fluorescence -- As in the TPH analysis, sample throughput for metals analysis is equally important for this field investigation. For this reason, the Spectrace 6000 XRF will be used for the analysis of total chromium. This analytical procedure requires minimal sample preparation, provides rapid turnaround times, has a dynamic range that corresponds to typical soil concentrations (from a few ppm to 100 percent), and furnishes accurate quantitative analysis.

This instrument is capable of accurately determining concentrations of chromium in soil with a practical quantitation limit of 20 mg/kg with a relative standard deviation (RSD) within 10 percent. Based on a preliminary action level of 400 mg/kg, this instrument will be quite capable of accurately determining concentrations within the required range. Although there are no EPA approved methods for XRF, this instrument has been accepted by the EPA for generating both screening-level and definitive data.

The method detection limit (MDL) for the XRF will be determined in general accordance with the procedures set forth in 40 CFR 136 Appendix A. However, because the matrices to be analyzed at CNTA are solids (soils and drilling mud), 100 mg/kg soil standards obtained from the National Institute of Standards and Technology will be used for the MDL determination rather than spiked, deionized water described in the CFR method.

Hexavalent Chromium by SW-846 Method 7196A -- Due to the potential for the presence of hexavalent chromium in the drilling mud and drilling mud-contaminated soils, the 24-hour holding time requirements for hexavalent chromium analysis, and the logistical difficulties in sample shipping from a remote site, this colorimetric analytical procedure will be used by the on-site laboratory. Prior to analysis, the samples will be digested using SW-846 Method 3060A (EPA, 1996b), which is a digestion method developed specifically for hexavalent chromium analysis of soils and other solid media.

Total Chromium by SW-846 Method 7190 -- The Flame Atomic Absorption method will be used to verify the total chromium analytical results from the XRF analyses. To determine the correlation between the FLAA and XRF chromium results, a total of 24 samples will be collected from the Central Mud Pit (a sample from four depths at each of six locations within the pit) and analyzed using both the FLAA and XRF methods. The FLAA and XRF chromium data from these samples will be used to perform a linear regression analysis between the FLAA and the XRF. The following are the decision rules to be applied based on the results of the regression analysis:

- If the regression coefficient (r) is greater than or equal to 0.95, 1/5 percent of all subsequent samples analyzed for chromium by XRF also will be analyzed by FLAA to verify the XRF results.
- If r is greater than or equal to 0.9, but less than 0.95, 15 percent of all subsequent samples analyzed for chromium by XRF also will be analyzed by FLAA to verify the XRF results.
- If r is greater than 0.8, but less than 0.9, 30 percent of all subsequent samples analyzed for chromium by XRF also will be analyzed by FLAA to verify the XRF results.

- If r is greater than 0.7, but less than or equal to 0.8, 50 percent of all subsequent samples analyzed for chromium by XRF also will be analyzed by FLAA to verify the XRF results.
- If r is less than or equal to 0.7, then use of the XRF will be discontinued, and all subsequent analyses for total chromium will be analyzed by FLAA.

The results of the subsequent XRF/FLAA split samples will be used to continuously reevaluate the correlation coefficient and apply the above decision rules. This will help to ensure that the total chromium data will be capable of supporting the decision-making process described in the next section.

C.2.3 Decision Rules for Chromium Analyses

As discussed in Section 3.4.3.3 of the CAIP, the preliminary action level for chromium is based on the generic soil screening level for hexavalent chromium developed by EPA (EPA, 1996a). The analytical approach for the project has been designed to identify samples that will be analyzed for hexavalent chromium to allow application of the decision rules identified in Section 3.4.5.

The XRF (or FLAA if XRF data is poorly correlated with FLAA results) will be used to initially screen each sample collected for its total chromium concentration. If the chromium concentration determined by XRF is greater than 300 mg/kg, the sample will be analyzed for hexavalent chromium by the on-site laboratory. The trigger level of 300 mg/kg has been selected as a conservative measure to ensure that samples with total chromium concentrations of close to, but below, the preliminary action level will be analyzed for hexavalent chromium.

Appendix D

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT DOCUMENT REVIEW SHEET

1. Document Title/Number <u>Corrective Action Investigation Plan for Central Nevada</u>		2. Document Date <u>January 1997</u>	
Test Area <u>CAU No. 417, DOE/NV-450</u>			
3. Revision Number <u>0</u>		4. Originator/Organization <u>IT Corporation</u>	
5. Responsible DOE/NV ERP Subproject Mgr. <u>Sabine Curtis</u>		6. Date Comments Due _____	
7. Review Criteria _____			
8. Reviewer/Organization/Phone No. <u>Paul J. Liebendorfer/NDEP/702-687-4670</u>		9. Reviewer's Signature <u>Transcribed from original</u>	

10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
General Comments				
1	M	"The 'QAPP' referenced in this document must be identified, in order to clarify which QAPP and what version is being utilized."	The text will be revised to indicate that the referenced QAPP is the <i>Industrial Sites Quality Assurance Project Plan</i> , Revision 1.	
2	M	"This CAIP needs to identify the DOE FTE who has direct responsibility for the QA DATA ASSESSMENT."	Section 3.4.3.4 of the CAIP has been revised to identify the DOE FTE who will be the Quality Assurance Coordinator for the project.	
3	M	"The text indicates probable use of offsite facilities. The specific offsite lab(s) need to be identified and its credentials for performing analyses for CAIP 417 must be included."	The off-site laboratory to be used for the project will not be selected until the CAIP has been approved and an estimate of the types and amounts of samples to be sent off site for analysis based on the approved CAIP can be made. It is likely that the selected off-site laboratory will be either Quanterra in St. Louis or Lockheed in Las Vegas, both of which are certified by the State of Nevada.	
4	M	"DOE still needs to provide the documentation to verify and warrant that all constituents of concern are being addressed, specifically the classified species of radionuclides."	The CAIP for CAU 417 includes specifications for drilling mud additives in Appendix B, which are the principal constituents of concern for the surface investigation. The classified radionuclides are a subsurface issue and will be addressed in the subsurface CAIP.	

^a Comment Types: M = Mandatory, S = Suggested.

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 CAU No. 417, DOE/NV-450

Revision Number 0

Reviewer/Organization Paul J. Liebendorfer/NDEP/702-687-4670

10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
Specific Comments				
i.4	M	"Expedited Site Characterization Methodology The core team descriptions in Appendix A do not give solid and clear qualifications of the individuals on the core team."	The qualifications of the specific personnel included in the core team for the CNTA surface investigation will be transmitted to NDEP with the revised CAIP, but these will be sent under a separate cover.	
3.4.2	M	"In subsections 1 and 2, the use of the word 'determine' immediately following the phrase 'the following decisions' weakens the force of making a decision. It is preferable to 'decide' than it is to 'decide to determine'."	The text will be changed to read "decide" rather than "determine."	
Table 3-1		"The 'NS or Not Specified' values for precision and accuracy goals should be given, even if only a 'best guess'. The CAIP should give acceptance/rejection criteria which enable the lab QAO to determine if XRF or spectroscopy should be used, establishing the accuracy, precision, and sensitivity necessary to use XRF."	The acceptability of XRF data will be based on the correlation between XRF results and FLAA results, as described in Appendix C.2.2. Table 3-1 has been revised to reference Appendix C.2.2 as the location where acceptance criteria for XRF use are described.	

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10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
Table 3-1	M	<p>"According to the allowable ranges for precision and accuracy, a sample with exactly 195 mg/kg of total chromium could be quantified in the range from 146 mg/kg to 244 mg/kg. Another way of saying this is that a reported value of 146 mg/kg could really be 195 mg/kg or a reported value of 244 mg/kg could really be 195. Duplicate samples with exactly 195 mg/kg would be found duplicate if the value of the duplicate was anywhere in the range from 263 down to 127 mg/kg. The ranges of acceptability given in this table suggest analysis at the limit of detection. Closer tolerances may be indicated since the action limit is much removed from the reporting limit which is much removed from the MDL. The ranges experienced by the lab during the on site analyses must be assessed in the QA Assessment by the lab QAO. If closer tolerances and higher reliability than the tables suggest can not be achieved, the DQO decision must be "insufficient reliable data for a decision".</p>	<p>Section 3.4.3.4 has been revised to indicate that the precision and accuracy goals will be evaluated using the results from field duplicate and matrix spike/spike duplicate samples and that the goals presented in Table 3-1 are separate from the analytical QC acceptance criteria identified in the specified analytical methods.</p>	

^a Comment Types: M = Mandatory, S = Suggested.

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10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
3.4.3	M	"Identification of inputs to the Decision Since the IS QAPP-1 does not fully detail the 5 numerical objectives of quality assurance, the CAIP must supply the missing acceptance/rejection criteria. The least amount of data for making confident decisions is absent from the Identification of Inputs to the Decision. The quality objective of representativeness is given as 90% certainty; however, the IS QAPP-1 prescribes the desired quality of representativeness at 95%. An explanation is required to be given as to what conditions allow for a lesser degree of confidence that the data adequately reflects the magnitude and distribution of waste. Comparability is not discussed. The use of X-ray fluorescence in a mobile lab is planned and doubt is raised as to the ease with which generated data can be used outside the confines of the CADD."	Section 3.4.3.4 has been revised to indicate that the precision and accuracy goals established for the project are separate from the analytical QC acceptance criteria identified in the specified analytical methods. The goals are intended to serve as additional criteria to assess how representative the field sample results are of the media sampled. All other QA objectives and QC acceptance criteria are specified in the Industrial Sites QAPP and the specified analytical methods. The statistical sampling design discussed in Appendix C.1 identifies the amount of data needed to support the decision-making process. The Industrial Sites QAPP does not specify a numerical criterion for representativeness. The 90 percent confidence level used in the CAIP was selected by the DQO process participants for the project.	
3.4.5.1.3	M	"Drilling Mud/Grout Piles In the last sentence of this section is the phrase "a limited number of remedial alternatives". Since the number is limited, the alternative should be identified and the decision matrix (types vs concentrations) for choosing the among the alternatives should be presented."	The identification of potential remedial alternatives has been deleted from all CAS group decision rule subsections.	

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10. Comment Number/ Location	11. Type ^a	12. Comment	13. Comment Response	14. Accept
3.4.5.2	M	"Miscellaneous Surface Sites This first paragraph of the subsection gives a simple decision rule, whereas the second paragraph is silent on that topic. Since section 3.4.5 addresses decision rules, a decision rule is needed."	The following will be added to the second paragraph: "If a petroleum product UST is found, it will be addressed in the CADD."	
3.4.5.3	M	"Additional Decision Rules The last sentence in this section gives the most significant and binding decision rule. If the information from the CAIP fails to corroborate the Conceptual Model, DOE will be required to compose and implement a revised CAIP."	The mobile laboratory will allow for a certain amount of flexibility in adjusting sample locations and sampled media to address changes in the conceptual model. Work will be terminated and the project will be rescope only if conditions are so different from what is expected that the investigative approach described in the CAIP clearly would not be useful for supporting the decision-making process for the site.	
4.2.1	M	"Mud Pits The last two sentences in the final paragraph (page 4-8) are contradicted by the evaluation in Appendix C.1.1.2, which estimates the number of samples in spite of the "unknown extent of the affected area". The phrase "the number can not be estimated at this time" is unacceptable. Every unknown can be estimated. The more reliable the information base, the closer the estimation can be."	The last two sentences of the last paragraph will be revised to be consistent with Appendix C.1.1.2.	
4.2.4	M	"Potential Underground Storage Tanks It would be preferable to use the Geoprobe to sample the soils under the potential UST rather than to take samples from the bottom of the tank."	As described in Section 4.2.5 of the CAIP, samples will be collected from inside of the potential UST (if one is present at the location) using a hand auger, not the Geoprobe.	

^a Comment Types: M = Mandatory, S = Suggested.

Distribution List

Controlled Copies

Paul Liebendorfer
Bureau of Federal Facilities
Division of Environmental Protection
333 W. Nye Lane, Room 138
Carson City, NV 89706-8518

2

Chuck Bulik
Bureau of Federal Facilities
Division of Environmental Protection
555 W. Washington, Suite 4300
Las Vegas, NV 89101

1

Sabrina Bonnell
Environmental Restoration Division
DOE/Nevada Operations Office
P.O. Box 98518, M/S 505
Las Vegas, NV 89193-8518

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Uncontrolled Copies

Sabine Curtis
Environmental Restoration Division
DOE/Nevada Operations Office
P.O. Box 98518, M/S 505
Las Vegas, NV 89193-8518

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Rick Deshler
IT Corporation, M/S 439
4330 S. Valley View, Suite 114
Las Vegas, NV 89103

1

Paul Gretskey
IT Corporation, M/S 439
4330 S. Valley View, Suite 114
Las Vegas, NV 89103

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Jeff Wurtz
IT Corporation, M/S 439
4330 S. Valley View, Suite 114
Las Vegas, NV 89103

1

Al Bevelo
Ames Laboratory
Iowa State University
125 Spedding Hall
Ames IA 50011-3020

1

Dave Wonder
Ames Laboratory
Iowa State University
125 Spedding Hall
Ames IA 50011-3020

1

Steve Gelb
McLaren-Hart
25 Independence Blvd.
Warren NJ 07059

1

Jennie Chapman
Desert Research Institute
755 East Flamingo Road
Las Vegas NV 89119

1